Section

7

Monitoring and Controlling Process Group

Project Management Manual Sections

7 Monitoring and Controlling Process Group

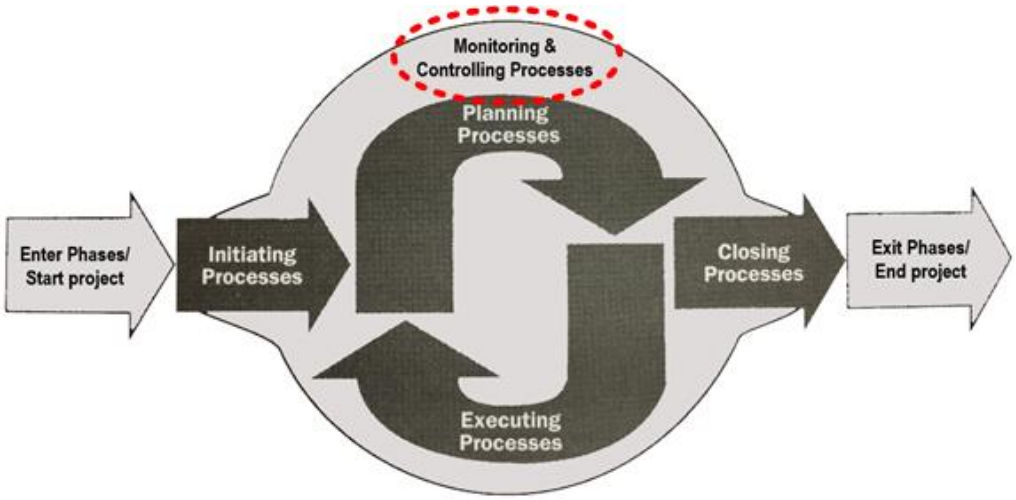
Monitoring and Controlling is the fourth of the five project management process groups. The purpose of this process group is to track review and regulate the project through all phases, including project management and product delivery tasks for all four project objectives (scope, costs, schedule, and quality).

Monitoring includes collecting, measuring, reporting, and distributing project performance information.

Controlling includes comparing actual project performance with planned performance, analyzing variances, assessing trends to effect process improvements, evaluating possible alternatives, and recommending appropriate corrective action as needed[11], and determining whether the actions taken resolved the performance issue.

To be effective, monitoring and controlling must be carried out in relation to a baseline, which will have been produced within the planning processes and documented in the Project Delivery Plan.

Figure 7-1. Monitoring and Controlling Process Group

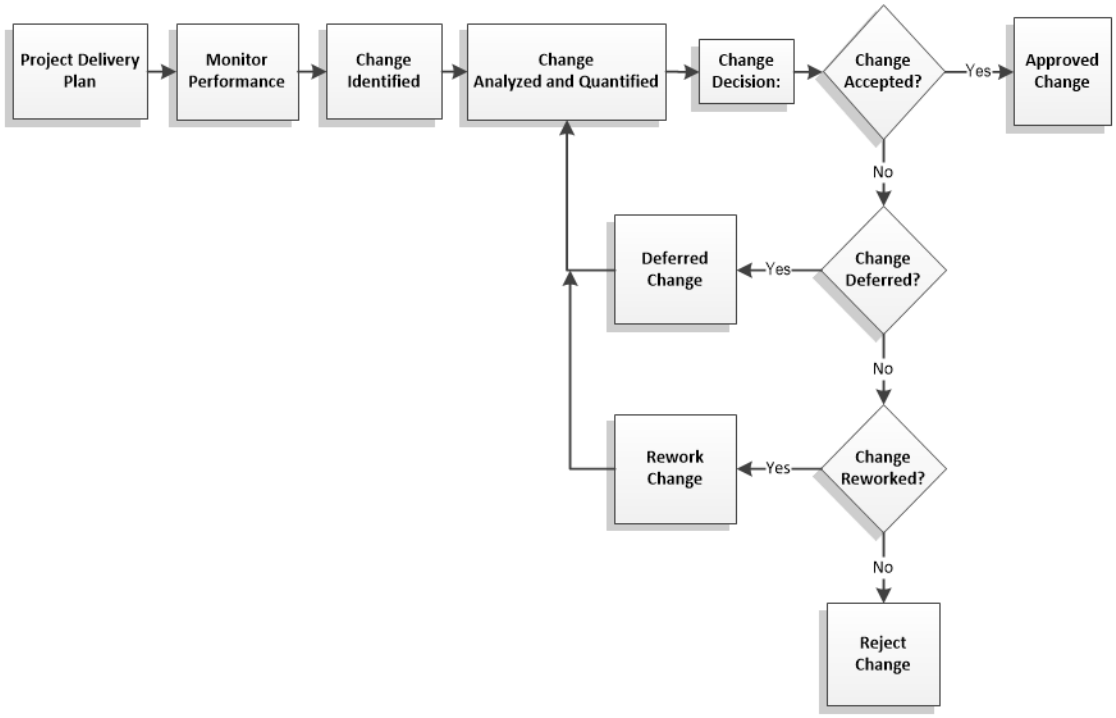


[11] Project Management Institute (2017). *A Guide to the Project Management Body of Knowledge,* Sixth Edition, p. 613.

7.1 Monitor and Control

Once the baseline has been developed and execution is underway, the Project Manager manages any variance to the baseline. Figure 7-2 notes the main components of the Monitoring and Controlling processes.

Figure 7-2. Change Control Process Main Components



The main components of the Integrated Change Control Processes:

Change Control Process	Description
Project Delivery Plan (PDP)	Serves as the baseline from which to monitor, control, and report specific project activities. The objective is to have the appropriate performance measures to identify potential change events and take corrective actions.
Monitor Performance	The objective is to identify potential problems early to prevent unfavourable events or minimize their impact. Integrated change control provides a process for managing changes, once they are identified. Performance reporting provides insight into potential and realized issues. For more information, refer to *PMM Section 7.5 – Report Performance.*
Change Identified	Once a change event has been identified as potential, forecast, or real, the Project Manager takes specific actions identified in the change control process to manage the change.

Change Control Process	Description
Change Analyzed and Quantified	The Project Manager analyzes and quantifies changes from respective baselines. The baselines could be either the product/service requirements or project-based criteria such as scope, cost, or time. The Project Manager quantifies the change, and determines whether the change is warranted. With each change the corresponding Business Case benefits must be continually assessed and updated. The change is vetted with the appropriate approval authorities such as Project Sponsors, Operations employees, Business Owners, or others identified in the Project Delivery Plan as having authority to approve specific changes. The review will result in the change decision.
Change Decision	The change decision results in the change either being accepted, rejected, or deferred: ▪ If the change is accepted, it must be approved and acted upon in a timely and efficient manner. ▪ If the change is rejected, the affected party must be informed and any fall-out managed using either the project issue resolution process or the procedures in the Contract documents. ▪ If the change is deferred, at a later time the change must be re-analyzed and re-quantified back through the change control process.

The industry generally recognizes that some change will occur, and changes should be accommodated within the applicable contract.

The Project Manager monitors the changes and determines whether they are reasonable or excessive (i.e.: indicative of errors or omissions).

7.1.1 Monitor and Control Scope

Controlling scope is the process of monitoring the status of the project scope and managing changes. The goal for project delivery is to achieve the benefits defined in the Business Case without any unwarranted changes to the scope. The assessment and quantification of changes in scope are always referenced to the approved baseline.

The following items provide the source of the baseline for scope control:

Scope Control Baseline Source	Description
Scope Statement	The Project Delivery Plan includes a scope statement describing the project in broad terms. The statement is important as it provides a common definition, which promotes understanding and buy-in among stakeholders. The Project Manager must track the project and check for alignment to the scope statement to maintain the confidence of the stakeholders who may not know the details of the contracts.
Project Delivery Plans	The Project Delivery Plan and Project Execution Plan identify detailed project management and product delivery tasks for each deliverable that must be monitored and controlled. Their work plans include the detailed task descriptions for studies and designs that state what is to be done, and what is to be delivered for each task. The Project Manager must monitor progress against these deliverables and identify deviations.

Scope Control Baseline Source	Description
Product Deliverable	Specific details of the products often evolve through the project lifecycle. The scope definition may change from the study to the preliminary engineering and design services. The changes must be monitored, and the project controlled accordingly.
Contracts	Contracts always provide some form of a scope in terms of either specific deliverables or performance.
Plans and Specifications	The scope for construction projects is packaged into much smaller components using drawings and specification clauses. The Contract usually requires each component to be included where the end result is the final product. Unless the project is performance-based, the scope of the project can be tracked and controlled through the specifications. The Work is expected to be completed in accordance with the Contract, and the deliverables are expected to be submitted as defined. If this is not the case, the Work is considered non-compliant if it is deficient or incorrect. If unspecified Work is completed, completion is out of scope. The Project Manager is responsible to proactively monitor and manage the Work, and when there are issues to manage the scope. The City's general conditions and relevant Contracts must be consulted for dealing with scope changes. The general conditions define how to manage scope changes, how to compensate for them, and how to manage disputes.

7.1.1.1 How to Verify Scope

Verifying scope is the process for formalizing acceptance of the completed project deliverables. It involves reviewing the project deliverables with the Project Sponsor and Business Owner, and formalizing the acceptance of the deliverables.

Verifying scope is the final step of the quality assurance review for each of the deliverables, and the final product, service, or result.

Scope verification can be achieved through the use of final acceptance certificates.

7.1.2 Monitor and Control Costs

Controlling costs is the process of monitoring the financial status of the project, and managing changes. All project delivery chain component costs must be monitored including the large Consultant and construction costs, and multiple other costs and fees, as described in *PMM Section 5.4 – Plan Cost Management*.

The Project Manager must proactively monitor and manage costs; reviewing the project routinely to confirm that costs and expenditures are as planned.

The process includes:

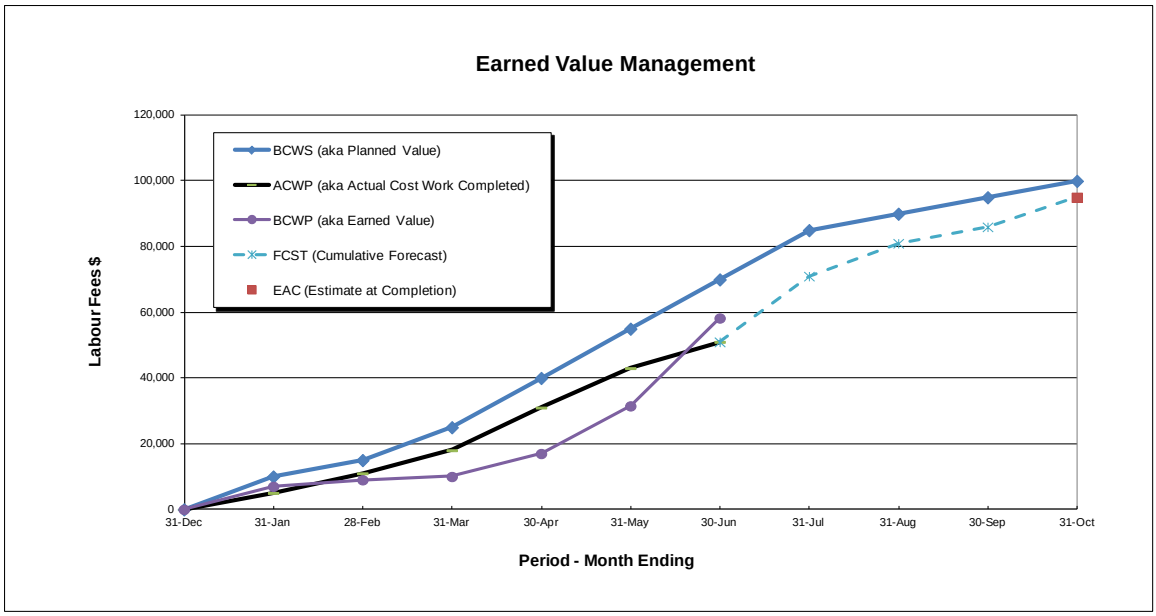
- Review and update costs and expenditures regularly.
- Account for any additional and unanticipated costs as soon as possible.
- Identify and track potential changes and additional expenditures.
- Account for inflation and other types of escalation throughout the project.
- Develop Estimate at Completion (EAC) forecasts on cost and performance trends.

All these costs, when added together and forecast to project close-out, must be within the approved budget. If they are not, the Project Manager must inform the Project Sponsor, and a recovery plan must be produced and added to the Project Delivery Plan.

The key to monitoring costs is to have a well-defined work breakdown structure (WBS) with work packages that can be readily measured and compared to their budgets.

Routine monitoring and reporting is completed using the Earned Value Management (EVM) method. The Earned Value Management Report integrates scope, schedule, and costs, providing complete information on progress and performance as shown in Figure 7-3.

Figure 7-3. Example Earned Value Management (EVM) Report



The Earned Value Management (EVM) Report provides a graphical representation of project performance. No EVM template is being developed as Microsoft Project has an EVM feature embedded within.

EVM also provides the basis for variance indicators:

- Schedule variance is a measure of schedule performance equal to the earned value minus the planned value.
- Cost variance is a measure of cost performance equal to the earned value minus the actual cost.

Progress payments must be billed in accordance with the contractual agreements. The only acceptable method for changing the amount to be billed is through a formal scope change (change in services).

Even with proper planning, execution, and safeguards contract amounts can change. The Project Manager must always be aware of circumstances, and prepared to deal with changes. The General Conditions allow for scope changes proposed by either the vendor or the City, and define how the fees are to be adjusted.

The City has the right to change the services at any time, and the Consultant may request changes through the change request process.

Conventional contracts are based on lump sum or unit price payments. There is a contractual obligation to perform the specified work for the approved price. While both Consultants and Contractors are vendors, and similar contract administration is carried out by the City, each type of contract is governed by a different set of General Conditions and must be administered accordingly.

Unit price contracts are amenable to most types of changes since the quantities are only estimated in the contract and final payment is made to the actual final measured quantity. For lump sum contracts, the quantities are thought to be known when the specifications are drafted, and payments for different quantities cannot be made without a formal scope change.

7.1.2.1 How to Perform EVM Calculations

The example in Table 7–1 illustrates how to perform EVM calculations.

Table 7-1. Example of an Earned Value Management (EVM) Calculation

WBS	Tasks	Labour Budget	31-Dec	31-Jan	28-Feb	31-Mar	30-Apr	31-May	30-Jun	31-Jul	31-Aug	30-Sep	31-Oct
BCWS (aka Planned Value)													
1.1.1	Deliverable 1												
1.1.1.1	Task 1	$10,000		$10,000									
1.1.1.2	Task 2	$20,000			$5,000	$10,000	$5,000						
1.1.1.3	Task 3	$25,000					$10,000	$15,000					
1.1.1.4	Task 4	$30,000							$15,000	$15,000			
1.1.1.5	Task 5	$15,000									$5,000	$5,000	$5,000
	Monthly Total	$100,000	$0	$10,000	$5,000	$10,000	$15,000	$15,000	$15,000	$15,000	$5,000	$5,000	$5,000
	Cumulative BCWS		$0	$10,000	$15,000	$25,000	$40,000	$55,000	$70,000	$85,000	$90,000	$95,000	$100,000
ACWP (aka Actual Cost Work Completed)													
1.1.1	Deliverable 1												
1.1.1.1	Task 1			$5,000	$1,000			$2,000					
1.1.1.2	Task 2				$5,000	$7,000	$3,000						
1.1.1.3	Task 3						$10,000	$10,000					
1.1.1.4	Task 4								$8,000				
1.1.1.5	Task 5												
	Monthly Invoices (Labour)		$0	$5,000	$6,000	$7,000	$13,000	$12,000	$8,000				
	Cumulative (ACWP)		$0	$5,000	$11,000	$18,000	$31,000	$43,000	$51,000				
BCWP (aka Earned Value)													
1.1.1	Deliverable 1												
1.1.1.1	Task 1			70%	80%	80%	80%	90%	90%				
1.1.1.2	Task 2				5%	10%	20%	50%	100%				
1.1.1.3	Task 3						20%	50%	90%				
1.1.1.4	Task 4								20%				
1.1.1.5	Task 5								5%				
	Total												
	Cumulative BCWP		$0	$7,000	$9,000	$10,000	$17,000	$31,500	$58,250	$0	$0	$0	$0
ETC Estimate to Complete													
1.1.1	Deliverable 1												
1.1.1.1	Task 1												$2,000
1.1.1.2	Task 2												$0
1.1.1.3	Task 3												$2,000
1.1.1.4	Task 4												$25,000
1.1.1.5	Task 5												$15,000
ETC (Estimate to Complete)													$44,000
EAC (Estimate at Completion)													$95,000

The above example is for a project valued at $100,000 to be completed between January 1st and October 31st.

The table is constructed according to the Work Breakdown Structure (WBS) with the work packages rolling up to deliverables, and the deliverables rolling up to project phases.

Note: *Only selected items from the WBS are shown in the table for brevity.*

The evaluation may be done for the entire project as a whole or viewed in portions if required. The EVM can include only the labour component if it is primarily a services project as is shown in the table or the total project costs if the other components are of interest.

The risk reserve contingency and management reserve are not included in the project EVM since they are managed and controlled as separate items. Once the contingencies have been converted to project costs through a formal scope change they then become included in the evaluation.

The Earned Value Management calculation is completed as follows:

- **Planned Value (PV)**: The Budgeted Cost of Work Scheduled (**BCWS**) is entered as planned for each task. This must include the work package level detail in the time increments to be monitored and controlled.
- **Actual Cost of Work Completed (ACWC)**: Actual Costs of Work Completed are based on the most current information available which, in many cases, may be Consultant or Contract billings.
- **Earned Value (EV)**: An Earned Value estimate is entered for each item, for each time increment, based on a bona fide estimate of the work completed. The example is structured in terms of percent completed.
- **Estimate to Complete (ETC)**: The Estimate to Complete is a bona fide estimate of the amount of work remaining to be needed to complete each work package for each time increment. The value is reported in terms of cost estimates to complete, however, the basis for estimating would normally be in terms of working time.
- **Estimate to Complete (EAC**): The Estimate to Complete is calculated from the addition of the cumulative ACWC and ETC.

The EVM is normally presented in graphical format as shown in Figure 7-3 – *Example Earned Value Management Report*.

The trend lines for the example were plotted in Microsoft Excel based on the cumulative rows highlighted in the table. One additional trend is included in the table for the Cumulative Forecast (FCST), which can be included if additional detail is required beyond the EAC.

7.1.2.2 When to Prepare a Recovery Plan

Cost overruns create concern because of the risk of exceeding the project budget and having insufficient resources to fully fund the project.

The Project Manager must report on the reason for the discrepancy and identify a method of recovery:

- If recovery can be achieved through corrective actions within the current work plan and contractual requirements can be met without changes to baselines, a formal recovery plan is not required.
- If the variation from plan is more significant and greater action is required, a recovery plan must be developed and included in the Project Delivery Plan. The recovery plan may include changes such as redesigning products or reducing scope.

The Project Manager must be prepared to deal with over expenditure forecasts through the integrated change control process described in *PMM Section 7.2 – Perform Integrated Change Control Process*.

7.1.3 Monitor and Control Schedule

Controlling the schedule is the process of monitoring the project and product schedules and managing changes. The schedules are defined in the Project Delivery Plan and in the Consultant and Construction contracts.

It is the Project Manager's responsibility to proactively monitor and forecast the schedule.

A schedule with well-defined tasks facilitates easier management. Knowing the expected duration of each task allows estimation of the completion time for comparison with the schedule.

Contracts specify that work will be completed in accordance with the schedule. If it is not, the work is contractually non-compliant. Any changes to the schedule must be formally approved through the Consultant or Construction change process. As part of the integrated change control process (Refer to *PMM Section 7.2.2 – Perform Integrated Change Control Process*) the Project

Manager must update the baseline schedule for all approved schedule changes, and assesses how the changes might affect the entire project.

The Project Manager is responsible for initiating or taking corrective action if the progress or updated schedule does not conform to the currently approved schedule. Corrective actions may involve adding more resources, working longer hours, or changing how the work is performed.

7.1.4 Monitor and Control Quality

Quality Control (QC) is performed throughout the project, and is monitored and recorded to assess performance and recommend changes. Quality standards are used for the monitoring and controlling processes.

The Project Delivery Plan will include a Quality Management Plan (QMP) for internal project management services and for the overall project delivery.

Consultants should have an internal quality assurance/quality control plan, which provides an additional quality assurance measure for the Project Manager.

For construction projects, the Contract Administrator monitors quality directly. Product quality standards must be included in the specifications, and the Consultant, the Contractor, or a third party must take the identified site quality control measurements. The Contract Administrator must confirm through the quality assurance process that quality control is taking place.

As quality concerns arise throughout the project, the Project Manager must define and log the problem and take corrective action. Failure to meet quality is a serious issue.

7.2 Perform Integrated Change Control Process

Integrated change control is the process of managing all change requests to baseline project documents and deliverables. Changes are often much more complex than they appear, a change to any one of the four objectives (scope, costs, schedule, or quality) is likely to impact at least one of the others, creating the need for an integrated change control process.

Changes can be a useful tool to enhance a project, however, they should only be approved if they add value. If they do not add value, changes should be rejected. The disadvantages to changes are that they can unexpectedly add to the project budget and suggest that the project was originally poorly planned or designed, or is being poorly managed – a perception that may or may not be accurate.

The PMM identifies a comprehensive integrated change control process applicable to the entire project delivery. Routine changes originating from Consultant services, Construction contracts, or any other sources must be evaluated with respect to the project objectives and baselines.

Direct and indirect impacts of the change must be identified and considered before the change is approved or denied. The process integrates contingency management and administrative over-expenditure procedures.

Baselines are critical to the change control process as they provide the reference and measuring point from which changes are evaluated. A thorough and accurate Project Delivery Plan as described in *PMM Section 5*, and comprehensive contracts as described in *PMM Section 6*.4 are essential to the process.

The General Conditions for Consultant services and Construction contracts include processes to address changes. Scope changes may address any component of the project objectives – scope, cost, schedule, or quality – and may involve either additions or deletions.

The Project Manager is responsible for reviewing and managing all Consultant changes in a timely manner according to the Contract, while the Contract Administrator is responsible for processing of Construction contract changes (with Project Manager input).

The General Conditions for both Consultant and Construction contracts require change requests to be documented and to include:

- Reason (Change classification)
- Detailed description
- Financial impacts

The General Conditions should be reviewed for each specific type of contract (construction, services, goods, consultant services, etc.) to determine the appropriate method of pricing changes.

The integrated change control process requires indirect impacts of the change be identified. For example, scope may affect schedule, and a minor change may have a major impact. The information needed to assess the overall impacts must be requested and evaluated before the contract change is approved or denied. The only exception is for a mandatory change for which either there is no option or time is of the essence.

Change Work Order template

Change in Scope of Services template

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There are two types of change orders:

- **Change Work Order (CWO)** which serves as the vehicle to issue a formal notice of a change to the Contract in accordance with the applicable General Conditions for Construction, Services, or Goods.
- **Change in Scope of Services (CSS)** which serves as the vehicle to issue a formal notice of a change to a Consultant Services Contract in accordance with the applicable General Conditions for Consultant Services.

After the merits and options for change orders have been reviewed and the change is approved, Change Work Orders must be signed by the Contract Administrator and Project Manager, and issued to the Contractor to formalize the change and update the contract.

For Consultant contracts, the Project Manager must review the change (Change in Scope of Services (CSS)), the budget impacts and the rules on over-expenditure before signing and issuing the change order.

For Construction contracts, the Contract Administrator, who has the authority to act on behalf of the City, must review the change (Change in Work (CWO)).

For most situations the Contract Administrator will consult with the Project Manager, prior to signing the change order, to assess the budget and other potential impacts. In urgent situations, the Contract Administrator may independently approve the change taking into consideration the City's delegated approval authority.

Contract Change Log template

Download from the City's Infrastructure Planning Office website

A change control tracking process must be maintained for all project changes as outlined in the Project Delivery Plan. The Contract Change Log template contains separate logs that should be kept for City project management changes, Consultant changes, and contract changes. The logs should include the change number, the approval date, the change category, related documentation, value of change and effect on schedule.

Anticipated changes are also to be included in the Contract Change Log. Frequently, the Project Team is aware of a potential changes, and tracking it increases the accuracy of financial forecasting.

All changes must be formally approved, which in effect makes a change to the contract, and the baselines must be updated to reflect the revisions.

The sum of all the estimated project costs, including updated contingency allowances, is used to forecast the Estimate at Completion (EAC) as defined in *PMM Section 7.1.2*. The EAC should be updated and compared with the approved budget regularly and with every major change.

The EAC must not exceed the approved Project Budget otherwise a recovery plan is required. If the recovery plan involves increasing the Project Budget, a re-budgeting process may be required and must be submitted to the appropriate authority for approval. If changes to individual contracts

will result in the total amount paid out under the contract to exceed the contract award amount, a contract over-expenditure approval will be required to increase the authorized award amount.

Changes are a concern when there are too many or the cumulative cost is too high. A high value of accumulated changes may be perceived as indicating they are being used to compensate for inaccurate or deficient work, poor planning, or inadequate project management.

The Project Manager must manage a process for categorizing changes to track their origin and reason.

7.2.1 Change Classification Codes

Change Classification Codes

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The Change Classification Codes are used to identify the reason for a change to a project and are used in the Contract Change Log.

These Change Classification Codes are important. These codes will be used in project metrics to assess improvements to the Project Management Manual, process, procedures and templates, to find ways for projects to be managed more effectively and efficiently at the City.

Classification of changes will also be useful in identifying "lessons learned" at the conclusion of a project or contract and useful in completing the Standard Performance Review for Consultants reports.

For some changes, more than one classification will apply. Select a single classification that *best fits* the reason for project change.

The change classifications are construction error, cost saving, delay costs, design deficiency, design improvement, force majeure, owner change, regulatory change, site condition, and third party impacts. Refer to the Change Classification Codes for additional information and examples for each classification.

7.2.2 How to Perform Integrated Change Control

Integrated change control takes place at the program (or project) level and/or contract level.

7.2.2.1 Change Control Process – Program/Project Level

The Change Control Process – Program/Project Level process is shown in Figure 7-5.

7.2.2.1.1 Identification Stage

Changes can be triggered by a variety of sources, including contract changes, or from Stakeholder or Business Owner requests.

In this stage, the source and type of the change requested should be documented in the project files or as set out in the Project Delivery Plan.

On major projects, the Project Delivery Plan may identify that the Project Record Index (PRI) method is to be used for change tracking. A sequential number would be assigned to the issue at this point if it is used, and the issue would be tracked by the number for all subsequent references to the issue.

7.2.2.1.2 Evaluation Stage

The evaluation stage includes:

- **Baseline Control Documents Impact** – The Project Manager must identify the product or service impact per the documents used to define the product being delivered. A needed design enhancement or modification could result from constructability concerns or design errors and could impact the project or contract scope, cost, schedule or quality.

The Project Manager must assess and quantify the change according to guidelines in appropriate baseline documents such as studies, design documents.

- **Project Management Impact** – The Project Manager must quantify the impact of the potential change and its magnitude in terms of effects on the Project Delivery Plan (scope, cost, schedule (time), quality, risk) and the benefits identified in the Business Case, once the change has been identified.
- **Document Evaluation Process** – The outcome of the change evaluation process shall be documented. Where the change to the project or program originated from individual contract, the various contract change logs, proposed change notices, change work orders, and other correspondence regarding the change should be retained in the Contract Administrator and/or Project Managers project files. Where the change to a program or project was initiated internally (no contracts affected), the change evaluation process and decisions should be documented.
- **Process Change** – The Project Manager determines whether the change has been forecast, is imminent, or has occurred.

  For a forecast change, the impact may or may not occur, so the Project Manager logs the change and records the cost impact as "pending" so the cost is recorded in the Forecast Cost Report.

  If the change is to be formally considered for approval, the Project Manager typically discusses the change with the impacted groups such as vendors, team members, Project Sponsors, the Business Owner, and Operations staff.

  If the change is not approved, the impacted party is notified and forecast costs are updated.

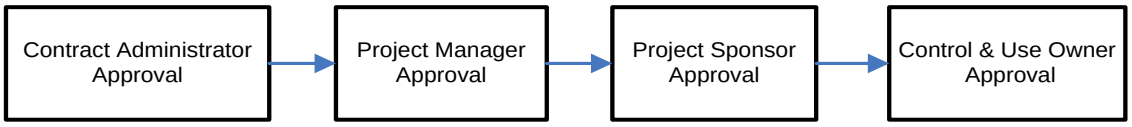
  In a contract environment, the Change Control Process – Contract-Level process is followed which is discussed in the next section.

  If the change is not in a contract environment, the Project Manager notifies the impacted party (the internal stakeholder or delivery team member) by email or a method appropriate for the type of project.

7.2.2.1.3 Approval Stage

The approval hierarchy for each project may be different and should be defined in the Project Delivery Plan. The typical approval hierarchy is shown in Figure 7-4.

Figure 7-4. Change Approval Hierarchy



According to FM-002 Materials Management Administrative Standard, the change cannot be approved unless sufficient funds exist for the change. Therefore, the Project Manager must decide when to process the change considering funding availability and the need for the change to proceed. The Project Manager may process a change considering unspent funds in the project budget, with the understanding that additional funds will be required at a future time. In this case, an over-expenditure report or additional budget fund report will be submitted.

If the change is for new scope not identified in the Project Delivery Plan, the Project Manager obtains new funds rather than taking funds from the contingency allowance which is reserved for known-unknown or unknown-unknown events. If these events were to occur and the contingency had been depleted, the Project Manager would need to justify additional funds for needs that had already been identified. The Project Manager will need to determine when the over-expenditure report should be submitted relative to the project status.

To gain additional funds, one of the following four methods is used:

1. Access any available funding from the project's cost codes (other deliverables).
2. Access contingency funding that may be appropriate (such as a risk event that has passed or been mitigated).
3. Transfer of funds from other sources in accordance with approved administrative policies and procedures.
4. Seek approval from Council for amendment of the adopted project funding.

For individual contracts, if contract changes result in a need to increase the contract award amount, an over-expenditure report must be submitted to the appropriate authority. The City cannot pay invoices on contracts where the award amount (i.e.: Purchase Order amount) has been exceeded.

7.2.2.1.4 Implementation Stage

If funding has been obtained or is available, the change can be formally approved. If no contracts are impacted by the change, the change is implemented and all impacted parties are notified. If contracts are affected (for example, in cases where a contract change was identified), the Contract Administrator (for Contracts) or Project Manager (for Consultant Contracts) will issue a Change Work Order (CWO) or Change in Scope of Services (CSS). All impacted parties should be notified and all decisions documented.

7.2.2.2 Change Control Process—Contract Level

The Change Control Process – Contract Level process is shown in Figure 7-6. Recall that contracts for construction, services and goods are administered by a Contract Administrator (CA) who may be internal or external to the City, while consultant contract are typically administered by a City Project Manager, and has authority analogous to those of a Contract Administrator. The General Conditions for each appropriate type of Contract outline the authorities of the Contract Administrator (or Project Manager) and how to address changes to the contract.

7.2.2.2.1 Identification Stage

Proposed Change Notice (PCN) – Consultant

Proposed Change Notice (PCN) – Construction

Proposed Change Notice (PCN) Log

templates

Download from the City's Infrastructure Planning Office website

Changes may be initiated by the Contractor (or Consultant), Contract Administrator or City. Contractors (or Consultants) identifying a change should notify the Contract Administrator (or Project Manager) in writing by submitting a Request for Information (RFI), or alternatively a notice of a change in work, or a notice of a change in the scope of work, as per the General Conditions. Once submitted, the Contract Administrator (or Project Manager) should record the information, and proceed to evaluate if it is in fact a legitimate change to the Contract. If it is not, the Contract Administrator (or Project Manager) shall respond to the change notice with their determination, at which point the Contractor (or Consultant) shall proceed with the work.

The Contract Administrator (or Project Manager)) should conduct an initial review to determine if the change is contractually legitimate and warranted. If not, this determination is communicated to the Contractor (or Consultant). If it is legitimate and initially deemed to be warranted but there is no time to prepare a Proposed Change Notice (PCN) and negotiate a mutually acceptable price, the Contract Administrator (or Project Manager) may issue a Field Instruction (or, in the case of consulting contracts, a Change in Scope of Services (CSS)) directing the Contractor (or Consultant) to proceed with the work, and prescribing the valuation of the work.

If at any time a Contractor (or Consultant) disputes the Contract Administrator (or Project Manager's) determination or valuation of a contract change, they may take up the dispute resolution process as defined in the contract.

Prior to issue of the PCN to the Contractor, if the Contract Administrator is external to the City, they should review the contents of the PCN with the City Project Manager. If the City is in agreement, the PCN shall be forwarded to the Contractor for their action. Pertinent details of the PCN should be logged by the Contract Administrator.

When a Contractor (or Consultant) receives a PCN, they will review its contents, and will respond with a written quotation identifying the increase, decrease, or no change in amount on the contract price as well as any schedule impact the contemplated Change in the Work will have on contract time.

A reasonable period of time (typically 5-10 business days) for the Contractor to respond to the PCN (depending on the magnitude of the change), and should be stated on the PCN as well as the method for valuation of the contemplated change (refer to General Conditions). The Contract Administrator (or Project Manager) shall maintain a log of all PCNs and their status in the Proposed Change Notice Log.

When receipt of the Contractor's (or Consultant's) response is in hand, the Contract Administrator (or Project Manager) shall record the date of the response and the amount in the Proposed Change Notice Log.

Note that the PCN template provides a space for the Contractor (or Consultant) to provide a quotation for the requested change, however, the PCN itself need not be filled out by the Contractor (or Consultant). Any manner of quotation (preferably in writing) may be issued from the Contractor (or Consultant) to the Contract Administrator (or Project Manager) such as by letter, email, or taken as meeting records during site meeting discussions, and deemed to be a legitimate quotation for consideration.

7.2.2.2.2 Evaluation Stage

The Contract Administrator (or Project Manager) shall promptly review the cost proposed by the Contractor (or Consultant), and if not acceptable, shall request them to provide further substantiation of the costs, or cost revisions.

If either the Project Manager or Contract Administrator becomes aware that the Contractor is performing the work prior to approval, the Contract Administrator shall immediately issue a stop work order to the Contractor. Under the legal concept of unjust enrichment, if the City is aware the Contractor is performing the work and does not stop it, the City may be responsible for the expense. This also is contrary overriding principle of the integrated change control process in that the cost is known in advance of the work.

The Contract Administrator (or Project Manager) logs all identified requests or queries that could affect the project on the appropriate project documentation, which helps track and manage all identified issues and their disposition.

Upon receipt of acceptable pricing, the proposed change should be vetted through the Program Project Change Control process (refer to Figure 7-5: *Integrated Change Control – Project Change Control Process Chart*). A similar process is followed to ensure the proposed change is necessary, warranted, and compatible with the business case, project objectives, and scope, cost, schedule, quality and risk considerations. Review may include consultation by the Project Manager with affected parties including the Business Owner.

If mutually agreeable pricing cannot be arrived at or it is taking too long and time is of the essence, the Contract Administrator (or Project Manager) may at any time issue a Field Instruction (or Change in Scope of Services) directing the Contractor (or Consultant) to proceed with the work immediately. The Contract Administrator (or Project Manager) may also set out the valuation for how the work is to proceed. The Contractor (or Consultant) must comply with the directive, and if they further dispute the determination of the Contract Administrator (or Project Manager), they may proceed to the dispute resolution process as defined by the contract. Dispute resolution can be costly and tedious, and every reasonable effort should be made to resolve disputes before they are advance to the formal dispute resolution process.

7.2.2.2.3 Approval and Implementation Stage

If the outcome of the evaluation stage is ***negative*** ('***No***' to change***)***, the project manager would notify all impacted parties and update the appropriate cost forecasts. If the change affects an active contract (for example, if the change originated as part of work being carried out under a contract), the Project Manager would circle back to the contract level change control process to close off the change item, inform affected parties, and update contract documentation.

If the outcome of the evaluation stage is ***positive*** ('***Yes***' to change) and the decision is made to proceed with the change, the Project Manager shall then advance to the change approval stage.

If the change is a material alteration to a Council approved scope of work, or will result in the requirement to amend a project budget, a report to Council (or appropriate committee thereof) may be required. Project Manager's should consult with their Project Sponsor if this is the case.

If no contracts are affected by the change, and sufficient funding is available (either within the project itself, contingency management, in a Program, or available to be transferred from other projects by the appropriate authority, then the change may be implemented. Because no contracts are impacted by the change, the issuance of CWO's or CSS's are not necessary, and the Project Manager can proceed to update their project delivery plans, project documents, and notify impacted parties of the decision.

If an open contract is affected by the change, but no additional funds are required, the change may be implemented by issuance of a CWO (or CSS). If additional funds are required, and are not available within the project or program, an over-expenditure approval may be required to increase the contract award amount. The over-expenditure approval process can take time, and similar to issuance of a Field Instruction, if time is of the essence, the Project Manager should seek agreement from the Project Sponsor and/or Business Owner to proceed with the change without formal over-expenditure approval. In this case, over-expenditure approval will occur after the work of the change has been executed.

In the case when contract administration services are being provided by an external party such as a Consultant, the Contract Administrator will obtain approval from the City Project Manager to authorize a Change Work Order.

Figure 7-5. Integrated Change Control - Program/Project Level Change Control Process Chart

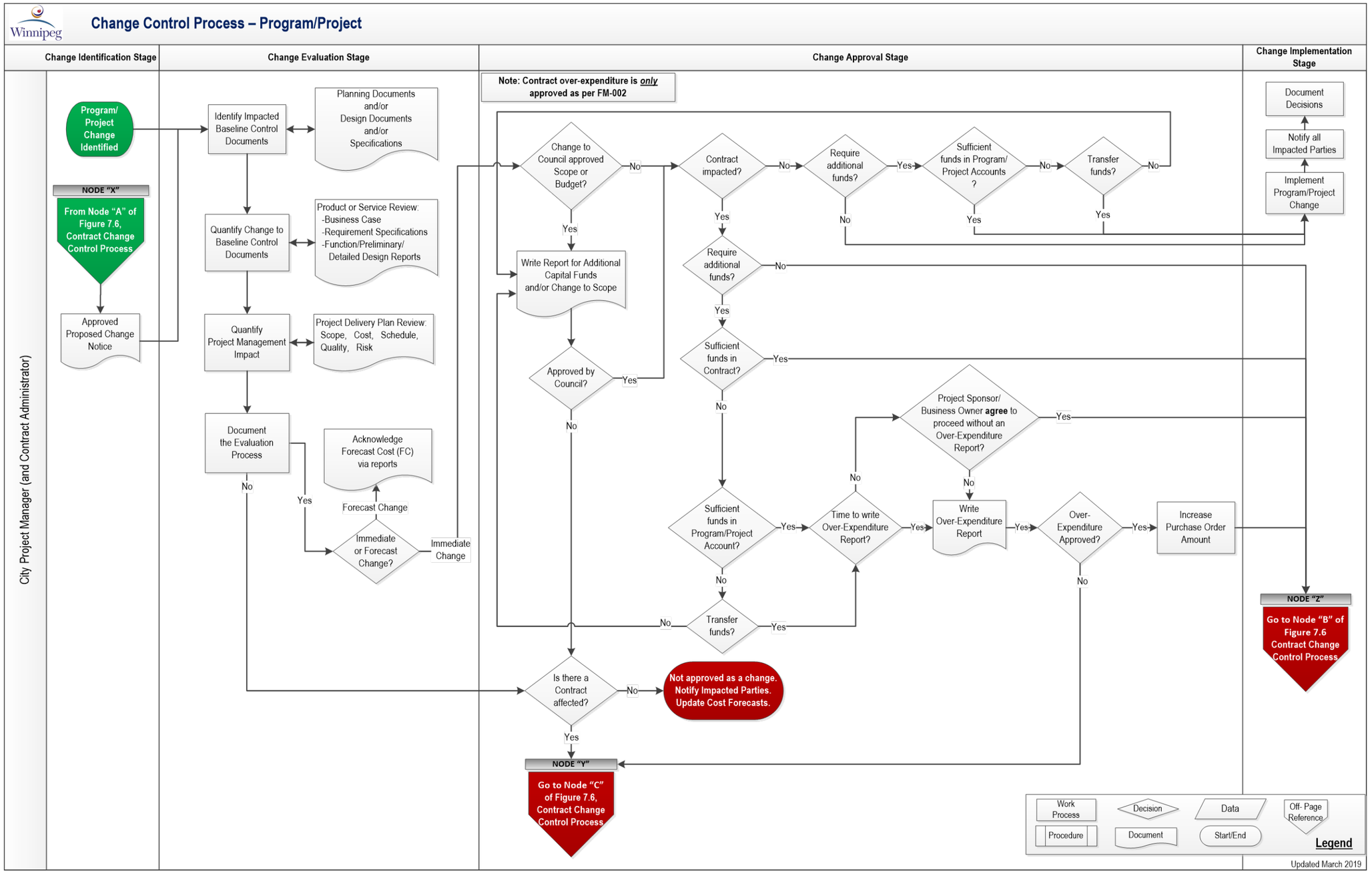


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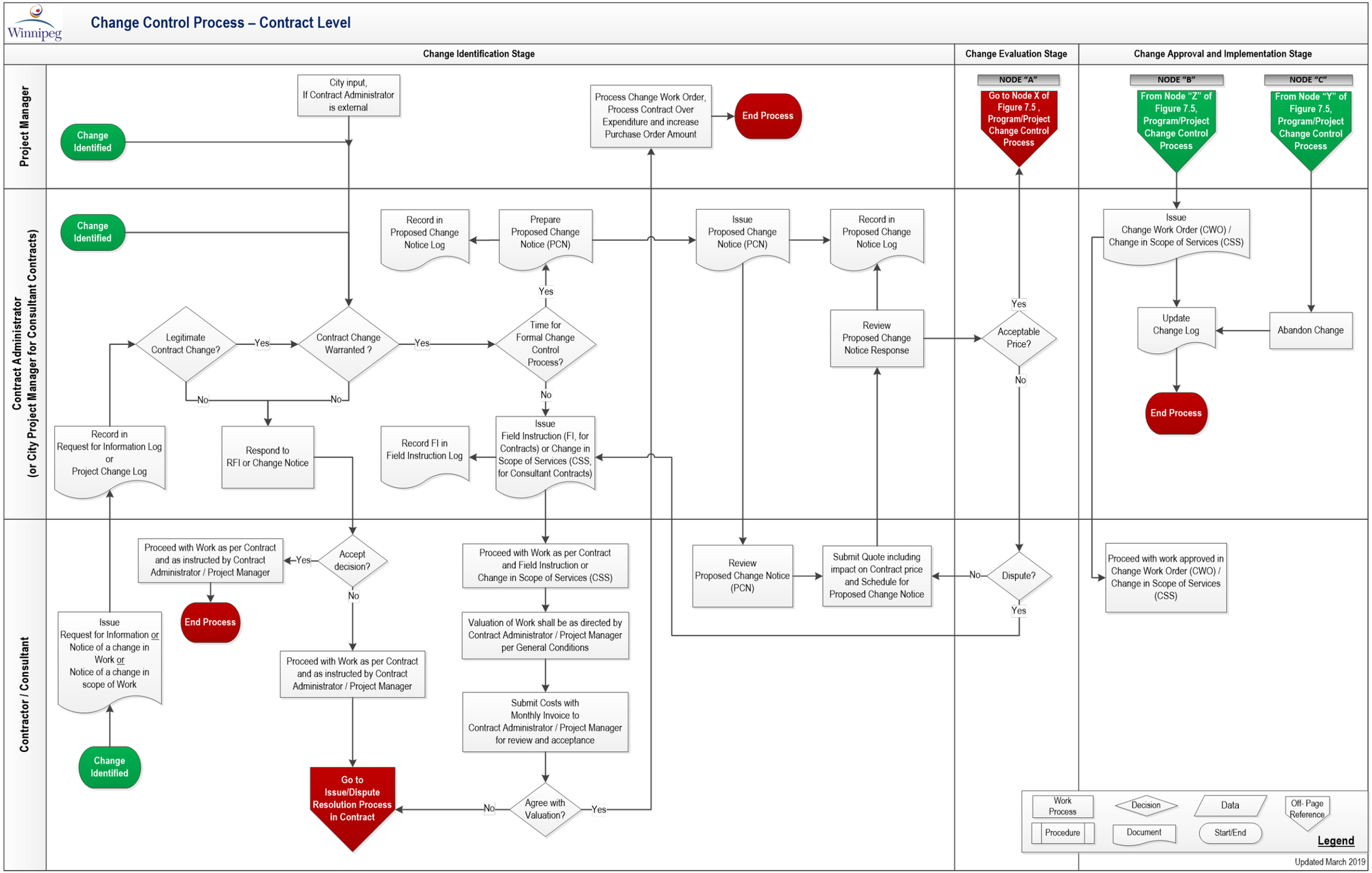
Figure 7-6. Integrated Change Control - Contract Level Change Control Process



7.2.3 Contract and Program/Project Level Change Examples

7.2.3.1 Example 1: Change to project initiated by City, no Contracts affected.

Project involves the construction of a new library. The project has a Council approved Business Case and funding, however at this stage, no contracts (for external Consultants or Contractors) have been awarded.

During early project planning, City Operations informs the Project Manager that an outdoor classroom area would be beneficial to the site, to accommodate outdoor engagement with visiting school groups and other youth activities and programs.

At this point in time, the Project Manager would evaluate the proposed change as per Figure 7-5 Integrated Change Control - Program/Project Level Change Control Process.

Assume the change is deemed warranted given the project objectives. The Project Manager would update the forecast cost projections, and finds that no amendment to the project budget is required. The Project Sponsor and Business Owner agree that this is not a material change to the scope of the project as approved by Council. Since no contracts are affected, the decision to proceed with the change to the project would be documented, and all impacted parties would be informed. Project planning documents would be updated (Basis of Estimate (BoE), Project Delivery Plan (PDP), Risk Register, etc.) to reflect the added scope of the project.

7.2.3.2 Example 2: Change to project initiated during performance of a Contract

Assume the library example discussed above has advanced to design and construction. A Contractor is currently constructing the main library building. It is noticed by the Contractor, via a Request For Information (RFI), that window security bars were not specified by the designer for basement windows on a portion of the building facing a dark alley.

The Contractor is asking if bars should be added. Upon initial review, the Contract Administrator and Project Manager decide that the bars may add value to the project, but this is not schedule critical, so they request pricing for via issuance of a Proposed Change Notice (PCN) to the Contractor. After some negotiation, a reasonable quotation from the Contractor is received.

Up until this point in time, Figure 7-6 Integrated Change Control - Contract Level Change Control Process is being followed. At this point, the Project Manager then reviews the change to the project (in light of received pricing, value added to the project objectives, etc.) as per Figure 7-5 Integrated Change Control - Program/Project Level Change Control Process. The Project Manager may determine that the change does indeed contribute to the project objectives, is of good value, and is warranted. If that is the case, they would proceed to the change approval stage.

Assume the change is considered to be within the Council approved scope, and within the approved project budget. However, assume the Contract for the library is a lump sum contract, thus the addition of the bars would effectively increase the cost of the Contract. The Project Manager would therefore need to write a contract over-expenditure report at some point in order to increase the contract award amount (i.e.: purchase order).

With the Project Sponsor's agreement, with the change being relatively small in value and warranted, the over-expenditure report may be deferred to a later date. At this time, the Project Manager would circle back to Figure 7-6 Integrated Change Control - Contract Level Change Control Process and (with the Contract Administrator) issue an authorized Change Work Order to the contractor for addition of the window security bars. The contract administration documentation (i.e.: logs) would be updated appropriately and the Contractor would proceed with the work for the agreed price.

7.2.3.3 Example 3: Cost saving credit on deleted Contract work

Continuing with the library scenario from Example 1 above, assume that the outdoor classroom has been designed and is included in the construction contract. Due to some unrelated contract issues and unforeseen site conditions, the construction project is tracking over budget, and the Project Manager and Project Sponsor have determined that deletion of some work needs to occur to keep the budget on track.

The Project Manager (through consultation with other City staff and the Business Owner) determines that the outdoor classroom is not a necessary part of the project scope, and should be considered for deletion from the project.

At this point, that starting point for the process is Figure 7-6 Integrated Change Control - Contract Level Change Control Process. The Project Manager and Contract Administrator determine that the change is warranted, but construction of the classroom is still a couple months away, so there is time to prepare and issue a Proposed Change Notice. This is done, and the Contractor provides a credit quotation in the amount of $90,000. The tendered cost of the classroom item was $100,000, however, through negotiations with the Contractor, some costs related to equipment mobilization and site preparation have already been made. With acceptable pricing (credit) in hand, the Project Manager would advance to Figure 7-5 Integrated Change Control - Program/Project Level Change Control Process Chart. At this point, the Project Manager would formally evaluate the proposed change as per the evaluation stage and conclude that deletion of the classroom would put the project back on budget, and be an acceptable modification to the project scope, as the project is still achieving the project objectives originally intended, at an acceptable level of service.

As before, this is not a material change to the Council-approved project scope. However, a contract is impacted by this change. No additional funds are required as this is a credit, and no contact over-expenditure needs to be processed as there is no need to increase the contract award amount.

Following Figure 7-5 Integrated Change Control - Program/Project Level Change Control Process Chart Change Approval Stage, the Project Manager would then proceed to circle back to the Figure 7-6 Integrated Change Control - Contract Level Change Control Process, and issue the authorize Change Work Order for the credit. The Contract Administrator would update the relevant contract documentation, and the Project Manager would update the project forecasts. Impacted parties would be informed of the approved change. The Project Manager may wish to examine if the change leads to changes to other contracts. For example, contract administration services are being performed by an external consultant, and the Project Manager may wish to seek a reduction to their contract as their coordination and inspection fees related to construction of the outdoor classroom may also be reduced.

7.3 Manage Contingencies

Changes are recognized as a reality in project delivery, and the change control process is an industry accepted practice. Most projects are set up with contingency budgets to accommodate moderate changes, as defined in *PMM Section 5.4*, and described for risk in *PMM Section 5.9*.

The Project Management Manual identifies the following contingency types which are managed specifically according to its purpose and defined expectations:

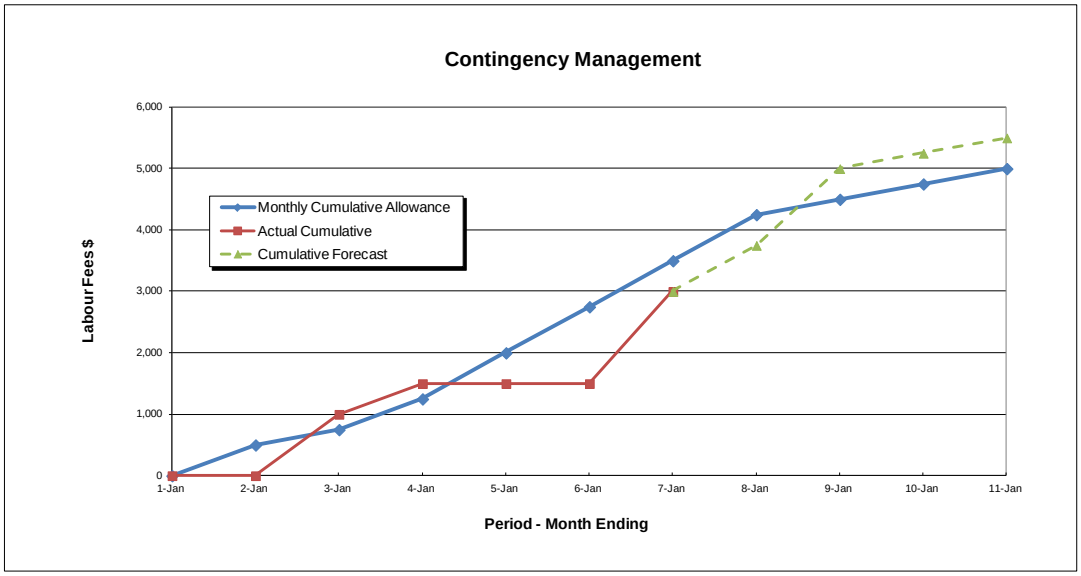
Contingency Type	Description
Cost-estimating	Cost-estimating contingency is mentioned here for completeness, however, it is not part of the formal scope change, project or product monitor and control processes. The cost-estimating contingency for the product is replaced at the contract award stage with the capital cost allowance.
Capital Cost Allowance	Capital Cost Allowance contingency is established for changes to construction and occasionally consulting contracts, based on normal industry practice. The amounts are monitored and controlled through the scope change process. To avoid unexpected overruns, it is important that the actual amounts be tracked and compared with the allowance value remaining.
Risk Reserve	Risk Reserve contingency is a separate budget amount added to the project budget for any risks warranting a contingency risk response. Continual risk review is required. As risks are realized, the risk reserve contingency is released by change order to compensate for the consequences of the risk as required. This in effect, draws down from the risk reserve contingency and increases the project cost. Outstanding risk allowances are tracked and compared to the budget. If the potential risk event passes without being realized, the contingency value reserved for that potential risk must be retired. The retired funds then become surplus to the budget and are allocated according to the Project Delivery Plan or the Project Sponsor's discretion.
Management Reserve	Management Reserve contingency is controlled by the Project Sponsor and is managed through the change control process, if the change directly impacts the project or product delivery.

7.3.1 How to Manage Contingencies

The Capital Cost Allowance, Risk Reserve and Management Reserve contingencies, as identified in the Project Delivery Plan are included in Project Budgets for specific reasons and must be tracked and managed to fulfil those needs.

These contingency types will have separate Work Breakdown Structure (WBS) codes and can be tracked much like the project budget and cost values using the Earned Value Management (EVM) approach. Figure7–7 shows an example of tracking a Capital Cost Allowance.

Figure 7-7. Example of an Earned Value Management (EVM) Report for a Project Contingency Account



The rate of expenditure can be estimated considering the expected rate of progress and knowledge of when contingencies are most likely to be drawn (risk event is expected to occur). New information can be applied to the forecast as the project proceeds to estimate the contingency expenditure at completion. This tracking method and forecast provides a useful tool for anticipating problems.

Contingency is released by change order to deal with the consequences of the specific risk event when it is realized.

- For the Capital Cost Allowance contingency, the risks are unknown-known, which means a variety of risk events are expected to occur however the extent of expenditures is somewhat predictable. An example in practice may be the release of funds for scope changes on a construction contract for situations such as encountering an unmarked utility during an excavation.
- Risk Reserve contingency provides a way to deal with two types of risks:

  (1) systemic risk which are unknown-known, and

  (2) project-specific risk, which are known-unknown.

  The risk quantification process of *PMM Section 5.9– Plan Risk Management* can be used to quantify both of these risks. The systemic risk is managed much like the Capital Cost Allowance, while the project-specific risks are managed based on the discrete risks.

The use of contingency is expected to be variable because by its very nature, it deals with uncertainty. If the budgets have been established at a high confidence level, then in most cases, the projects will close with a surplus contingency amount.

A strategy needs to be established for how to deal with surplus contingencies.

- For the Capital Cost Allowance contingency, the expenditures could potentially arise at any time and unless there is a large disparity between the forecast and actual cumulative expenditures, the surplus should not be retired or re-allocated until completion of the project it was intended for.
- The Risk Reserve contingency allocated for systemic risks is much like the Capital Cost Allowance contingency, and unless there is a large disparity between the forecast and actual cumulative expenditures, the surplus should not be retired or re-allocated until completion of the project it was intended for.

- The Risk Reserve contingency will have discrete amounts identified for project-specific risk events. Once the chance of the risk has passed or been eliminated the contingency is theoretically not required.

  The options for managing the surplus in these cases are as follows:

  - Retire the risk and reallocate the budget: After the potential for a risk has passed, the risk quantification described in *PMM Section 5.9 – Plan Risk Management* can be recomputed with the risk removed, and a revised contingency value determined. The difference in the calculation between the original and reduced risk will be the amount that can be retired or reallocated.
  - Retain the risk amount in the risk reserve contingency: The risk reserve allocations for project-specific risks will only partially cover the consequences if the risks are realized. As the project proceeds and the number of remaining risks reduces there will be a reduced amount of shared risk contingency available if the contingencies are progressively retired. It is therefore prudent to retain some of the contingency in case of a risk occurring late in the project.
  - Release all outstanding risk contingency at the end of the project: Projects structured with the contingency values set at high confidence levels are likely to at least periodically result in significant amounts of risk contingency remaining at the end of the project. This surplus is then available to be reassigned based on established budgeting procedures.

7.3.2 Contract Over-Expenditure Procedures

Procedures for over-expenditures and the delegated authority to approve them are set out in Appendix 7 Contract Over-expenditures in FM-002 Materials Management Administrative Standard. The following is a summarization of those procedures. In case of disagreement, the FM-002 Administrative Standard shall take precedence.

Accumulated change orders that do not cause the Contract to exceed the amount of the award can be approved by the Contract Administrator.

Accumulated change orders that will cause the Contract to exceed the amount of award cannot be approved by the Contract Administrator, and requires additional approval by way of an Over-expenditure Report. The level of approval required depends on the delegated approval authority as set out in FM-002 Materials Management Administrative Standard.

Under FM-002, the CAO delegates their authority to the CFO to approve over-expenditures where the accumulated over-expenditure does not exceed $5 million dollars and there is available capital or operating budget as approved by Council. For clarity, the accumulated over-expenditure means the accumulated amount of the over-expenditure only, and is not the total contract amount, including over-expenditures.

Under FM-002, the CFO further delegates the following:

- All Department Heads can approve over expenditures within budget, as long as, the total
- contract value including over-expenditure, does not exceed $5 thousand dollars.
- The Department Heads of Planning, Property & Development (PPD), Public Works (PW), Transit and Water and Waste (WW) can approve over-expenditures within budget as long as the total contract value, including over-expenditures, does not exceed $100 thousand dollars.
- The Department Heads of Planning, Property & Development, Public Works, and Transit can also approve over-expenditures within budget for total contract values beyond $100 thousand dollars, as long as, the amount of the over-expenditures does not exceed 20 percent of the original contract value, to a maximum of $250 thousand dollars.
- The Department Heads of Water and Waste can also approve over-expenditures within budget for total contract values beyond $100 thousand dollars, as long as, the accumulated amount of the over-expenditures does not exceed 20 percent of the original contract value, to a maximum of $500 thousand dollars.

- In instances where the amount of the over-expenditure exceeds $5 million dollars but is within the budget approved by Council, the over-expenditure may be approved by the relevant Standing Policy Committee.
- In instances where additional budget is required to cover the over-expenditure, the over-expenditure must be approved by Council.

The above information is summarized below in Table 7-2.

Table 7-2. Summary of Over-Expenditure Approval Levels

Over-Expenditure Approval Levels			
Change Order(s)	Project Budget	Required Approval	Comments
Accumulated change orders do not cause total contract to exceed the amount of award	Within Budget	Contract Administrator	Contract has been awarded and approval of change order will not increase the contract value beyond the amount of award
Accumulated change orders increase contract beyond award amount however within Department Head Authority	Within Budget	Department Head	Department Heads of PPD, PW & Transit – $100 thousand dollars or 20 percent of original contract value to maximum of $250 thousand dollars
			Department Head of WW – $100 thousand dollars or 20 percent of original contract value to max of $500 thousand dollars All other Department Heads can approve over expenditures as long as the total contract value does not exceed $5 thousand dollars
Accumulated change orders increase contract beyond award amount however within CFO Authority	Within Budget	CFO	CFO has authority to approve accumulated over-expenditures up to $5 million dollars
Accumulated change orders increase contract beyond award amount and over CFO Authority	Within Budget	Relevant Standing Policy Committee	Standing Policy Committee can approve Over-expenditure Reports over the CFO's delegated authority as long as it does not exceed the approved budget
Accumulated change orders increase contract amount over Council approved Budget	Additional Budget Required	Council	Any project that requires additional funding requires Council approval. Alternative funding sources are identified and recommended in the over expenditure report

In some instances in construction projects, obtaining the approval in advance of the change order would cause construction to halt and result in delay claims adding additional cost to the City. Under these circumstances, and ***where there is approved budget available in the project***, the Project Manager may use their professional judgment and obtain administrative approval after the fact. In these circumstances, it may be beneficial for the Project Manager to obtain approval by email with a formal report to follow. Approvers may prefer to accumulate changes and consolidate into a single Administrative Report towards the end of the project.

In instances where the over-expenditure will cause the project to exceed budget, Administration does not have the delegated authority to approve the over-expenditure. The additional budget can only be approved by either the relevant Standing Policy Committee or Council. As such, the Project Manager should not be approving changes beyond budget as it exceeds administrative authority and essentially commits the City to additional expenses without Council approval.

7.3.3 Funding Over-Expenditures

FM-002 authorizes departments to transfer funds from a non-specified Capital Account to cover over-expenditures. Reallocations are permitted to a maximum of $100,000 or 25 percent of the base budget.

In instances where the over-expenditure will cause the project to exceed budget, Administration does not have the delegated authority to approve. The additional budget can only be approved by either the relevant Standing Policy Committee or Council.

7.4 Manage Risks

Monitoring and controlling risks is the process of implementing risk response plans, tracking identified risks, and identifying new risks. Risk management must be carried out according to the Risk Management Plan's schedule, which at a minimum, includes reporting to the Project Sponsor, Major Capital Project Advisory Committee and/or Project Advisory Committee at the start of all new project phases or as defined in the Project Delivery Plan.

The risk register identifies the primary inputs for this process, including the risk owner, the risk response, and actions taken. The risk owner performs the identified actions, evaluates the situation as conditions change, and provides risk updates.

The risk assessment includes a review of the risk contingency reserve. If the amount in the reserve exceeds the amount of risk remaining, a recommendation should be made to reduce the contingency. Once a risk has been eliminated it must be closed on the risk register.

7.5 Report Performance

Report performance is the process of collecting and distributing performance information, including measurements, status reports, and forecasts.

Routine project management activities include collecting information such as reports and logs that can be used for tracking and evaluating performance.

The Project Delivery Plan defines standard reports generally required for every project and ad-hoc reports required for specific projects.

The reporting process provides information critical to assess project performance that the Project Manager must assess on an on-going basis to assess the performance of the project and make decisions.

Of particular interest for tracking the project are:

- Monthly Earned Value Management Reports for the project, as a whole, and Consultant and construction sub-projects.
- A monthly Estimate at Completion for the construction contract, consulting services, and the items comprising the total City project budget.
- Utilizing the Project Management Checklist template to indicate which of the Project Management Manual requirements that have been completed.