

9 Project Risks/Contingency

Project risks have been identified, and management responses and treatment plans have been developed per the Site C Project Risk Register.

The project team identified the following risks as key drivers for the evaluation of contingency requirements. For a full list of identified risks, refer to the Project Risk Register:

- **Contract risks**
 - **Competitive Bidding Processes:** The estimate assumes all direct construction costs are let through competitive processes, and that sufficient market response is achieved to ensure contract pricing does not include non-competitive premiums (e.g. markups greater than 15 per cent including home office expenses).
 - **Exchange Rate Fluctuations:** Certain materials and equipment, particularly associated with generating and stations equipment, will likely be manufactured outside of Canada; fluctuations in exchange rates may impact the cost of materials and equipment expressed in Canadian dollars.
 - **Development of contract terms and conditions** assumed that no onerous terms or conditions are placed; these contract terms were not available for review at the time of the estimate refresh.
 - **Payment Schedules:** Cashflows and associated inflation and IDC costs were based on the forecast schedule; contractors may provide an unbalanced bid (e.g. increased unit rates for earlier work) to generate positive early cashflows, which could impact project financing costs.
- **Schedule risks**
 - **Interface:** The procurement approach has condensed the number of anticipated contracts compared to the December 2010 estimate; however, a number of key interfaces remain which could result in schedule delays and/or claims from contractors who are unable to begin work as planned at the time of contract award.
 - **Regulatory Constraints:** Several constraints caused by regulatory or environmental commitments or regulations may present schedule challenges; for example, the three month reservoir filling window (related to the Migratory Birds Convention Act) could lead to a major impact on direct costs and IDC.
- **Construction risks**
 - **Constructability:** Detailed reviews of constructability have been conducted to ensure sufficient materials, laydown areas, and sequencing plans will provide a viable method of completing planned works; however, ongoing management of construction risks will be required throughout project construction.
 - **Delivery of Equipment:** Delays in delivery of key equipment could impact project schedule and result in contractor claims.

Cost Refresh Contingency Validation

The December 2010 estimate included [REDACTED] million (unloaded, \$2010) in expected contingency requirements, excluding Project Reserve amounts. This figure formed part of the basis for the total project cost of \$7.96 billion.

During the 2014 cost refresh, adjustments were made to cost elements as described in this memo, which represented an increase of [REDACTED] million (\$2010) in direct and indirect costs before loadings (including Capital Reserve for Operating Amounts, loaded). These costs were partially

offset by [REDACTED] million in financial savings due to changes in inflation and IDC forecasts, representing a net increase of [REDACTED] million.

Within the context of the published \$7.96 billion project cost, these changes were reflected as a draw from contingency in the refreshed consolidated financial model, leaving the project with [REDACTED] (\$2010) million in remaining contingency. It was noted that certain costs absorbed during this period, in particular the two-year schedule delay caused by revised regulatory timelines, were not originally intended to be managed through a P50 contingency.

As part of the 2014 Cost Refresh exercise, a new Monte Carlo model was developed based on the refreshed direct costs and reflecting the new procurement packaging. This model was used to assess the difference between remaining contingency consistent with the existing public estimate and an unconstrained contingency assessment.

The Monte Carlo model assigns probability distribution functions to anticipated contract packages based on four general sources of variability:

- Design: Potential variances caused by changes in design during development of Issue for Tender or similar designs, as well as modifications to design required during construction.
- Labour: Potential variances caused by fluctuations in market conditions for labour, turnaround costs, contractor burdens and shift and overtime premiums. This section provides for standard variances within normal economic conditions, and does not reflect the full range of potential outcomes in the event of labour market shock, e.g. caused by multiple major capital projects in the region during construction. This section also addresses variability in the number of contractor personnel requiring accommodation through the Worker Accommodation package.
- Estimate Accuracy: Potential variances due to changes in crew productivities, materials pricing, estimate contractor overheads and other factors different from the assumptions contained within the Cost Refresh estimate.
- Markup: Differences in contractor profit expectations.

For Management and Engineering costs, a static 10 per cent of costs was assigned as an appropriate contingency amount, which is consistent with typical BC Hydro allocations for costs under direct management. Construction Insurance and Bonding costs were also assigned a 10 per cent contingency.

Budgets for environmental, social and First Nations mitigation, compensation and benefits were assigned no contingency in the Monte Carlo model, as it is understood that these budgets are to be managed in such a way as to not exceed the assigned amounts. These budgets were not reviewed by Estimating as part of the 2014 Cost Refresh activity, and have been maintained by their respective Site C teams in coordination with Site C Finance. Any required contingency for these items is assumed to be within the overall line item budget. Forecast sunk costs at the time of Implementation were also assumed to have no contingency requirement.

A uniform correlation factor of 0.3 for all probability distribution functions was assigned within the Monte Carlo model, consistent with the PPM Estimating Procedure guidance.

The results of this summary are described below.

Contingency Summary								
Code	Package	EAC (\$2014)	50% P50 Contingency	Cont as % of DCC	Expected Amount	90% P90 Contingency	Res as % of DCC	P90 Amount
LR	Rights, Taxes and Grants							
HWY	Highway 29 Relocation and Hudson's Hope Berr							
CLR	Clearing							
ECW	Early Civil Works							
MCW	Main Civil Works							
GSS	Generating Station and Spillway							
TG	Turbines and Generators							
TF	Transformers							
SUB	Site C Substation							
TRL	500 kV Transmission Line							
PCN	Peace Canyon GIS Building Expansion							
MISC	Miscellaneous Items							
WA	Worker Accommodation							
CM	BC Hydro Construction Management							
Other	Value Engineering							
Total								
Contingency for Indirects (Mgt & Eng, Insurance)								
Contingency for MIU/Comp/Benefits Reserves								
Contingency for Sunk Costs								
Total (\$2014)								
Total (\$2010)								
Reconciliation and Variance from 2014 Refresh Monte Carlo to Remaining Contingency (\$2014)								
2010 Contingency								
Draw from Contingency, 2014								
Balance of Contingency per Financial Model								
P50 Contingency from 2014 Refresh Monte Carlo								
Variance Between Remaining Contingency and 2014 Refresh Monte Carlo								
Variance Between Remaining Contingency and 2014 Refresh Monte Carlo (\$2010)								
Remaining contingency Expressed as % of Total Costs (excl sunk cost)								

The available contingency of [REDACTED] million (\$2014) at the time the Cost Refresh was completed is consistent with a P48 estimate.

Overall, the Monte Carlo contingency analysis indicates the budget as presented in this document would require approximately [REDACTED] million in additional contingency budget (unloaded) to achieve consistency with a P50 estimate. In the context of the overall project budget of \$7.96 billion (loaded), this represents a relatively small variation from the original contingency model prepared in 2010.

Subsequent to the development of the Monte Carlo model, as part of the FID, additional budget was included to reflect costs associated with PST and a delayed construction start date. In addition, opportunities to reduce IDC through project-specific financing were also identified at the time of the FID. These amounts are not included in the contingency described above. The following costs reflect additional contingency subsequent to the completion of the Cost Refresh:

- [REDACTED] million schedule contingency, added as part of FID
- [REDACTED] million IDC savings, as reported by Site C Finance as the low end of expected cost savings from project financing
- [REDACTED] million PST contingency, after accounting for base PST estimated in direct costs

The above amounts reflected loaded dollars; based on the new anticipated loadings factor of 0.27 for the project (assuming lower IDC costs with project financing) represent an additional [REDACTED] million in contingency available at the time of FID.

The graphic below describes the revised contingency including these items, which represents a P68 budget, before Project Reserve.

Contingency Summary		EAC (\$2014)	68% P Contingency	Cont as % of DCC	Expected Amount
Code	Package				
LR	Rights, Taxes and Grants				
HWY	Highway 29 Relocation and Hudson's Hope Berm				
CLR	Clearing				
ECW	Early Civil Works				
MCW	Main Civil Works				
GSS	Generating Station and Spillway				
TG	Turbines and Generators				
TF	Transformers				
SUB	Site C Substation				
TRL	500 kV Transmission Line				
PCN	Peace Canyon GIS Building Expansion				
MISC	Miscellaneous Items				
WA	Worker Accomodation				
CM	BC Hydro Construction Management				
Other	Contingency for Value Engineering				
Total					
Contingency for Indirects (Mgt & Eng, Insurance)					
Contingency for Mit/Comp/Benefits Reserves					
Contingency for Sunk Costs					
Total (\$2014)					
Total (\$2010)					
Reconciliation and Variance from 2014 Refresh Monte Carlo to Remaining Contingency (\$2014)					
2010 Contingency					
Draw from Contingency, 2014					
Additional schedule, PST and loadings contingency					
Balance of Contingency per Financial Model					
P50 Contingency from 2014 Refresh Monte Carlo					
Variance Between Remaining Contingency and 2014 Refresh Monte Carlo					
Variance Between Remaining Contingency and 2014 Refresh Monte Carlo (\$2010)					
Remaining Contingency Expressed as % of Total Costs (excl sunk cost, mit/comp/bene					

Conclusion

Contingency is not included for items subject to external influences that are not under the control of the project manager/estimator, per the estimating procedure. Specifically, further delays to the project schedule caused by external factors such as significant legal or regulatory delays are also not reflected in the contingency model, and would normally be reflected as a Management Reserve item in a Project Reserve.

The contingency allowances consistent with the published \$7.96 billion project estimate, expressed as a percentage of the Total Construction Cost without contingency or loadings are as follows:

Contingency Level	Per Cent of Direct Project Cost Remaining	Contingency Amount (Unloaded)
Expected Cost Amount		

Note that no contingency is provided for sunk costs nor for mitigation or compensation-related budget items.

In addition to the base contingency described above, a further [REDACTED] million (direct) is available for contingency based on the FID budget and reduced IDC costs associated with project-specific financing.

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