Lower Churchill Project
8 – The Sanction Decision
June 2018

Boundless Energy

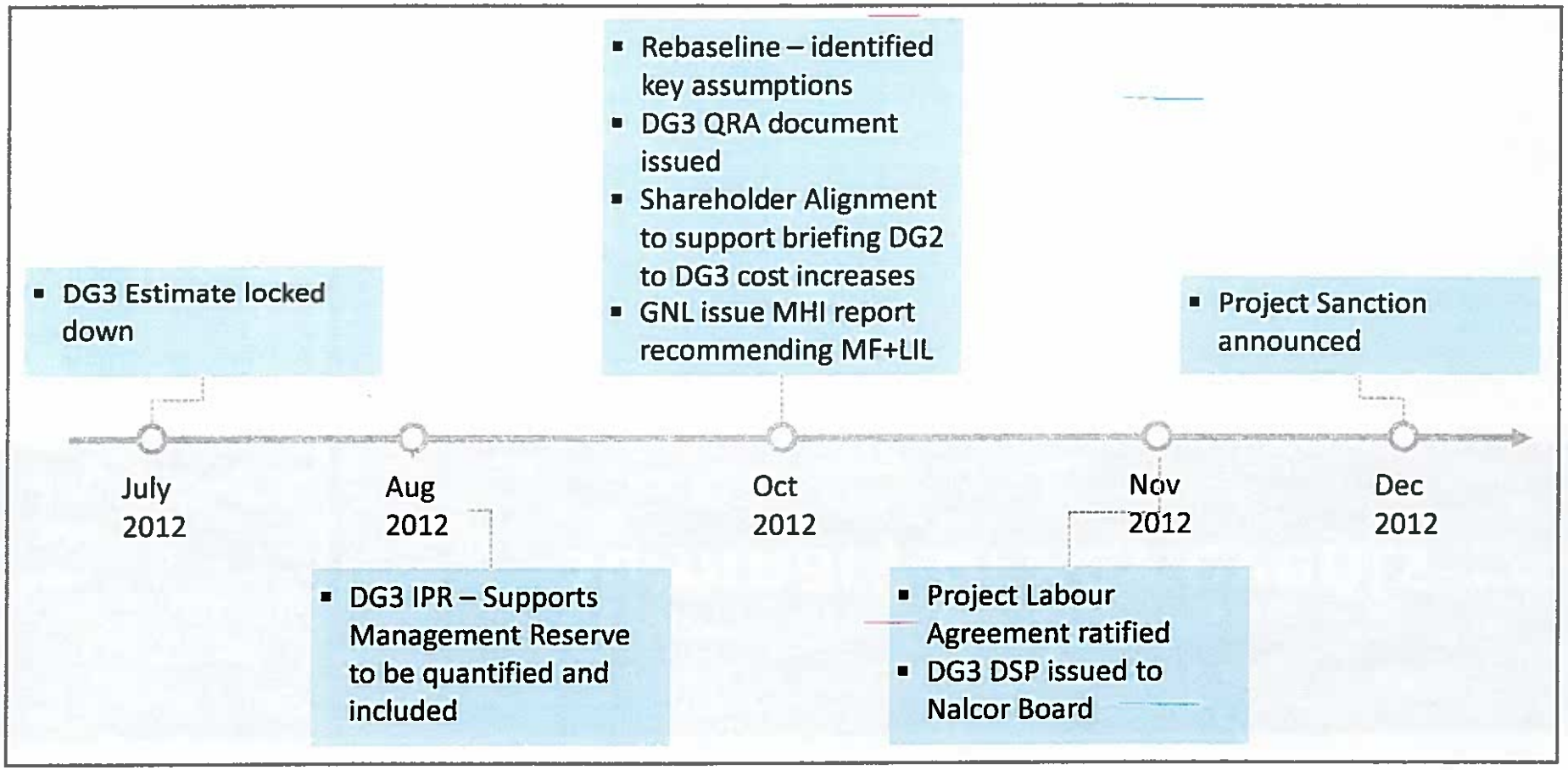
nalcor energy
LOWER CHURCHILL PROJECT

Privileged and Confidential in Contemplation of Litigation

Contents

Summary of key events

Summary of key events 2012 – 2013

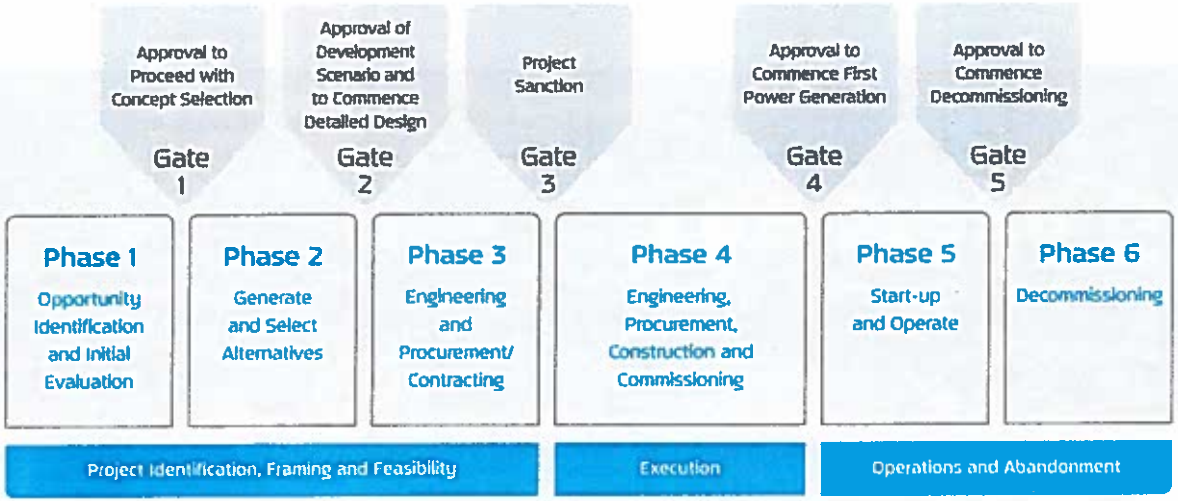


The Stage Gate Process

The Stage gate process

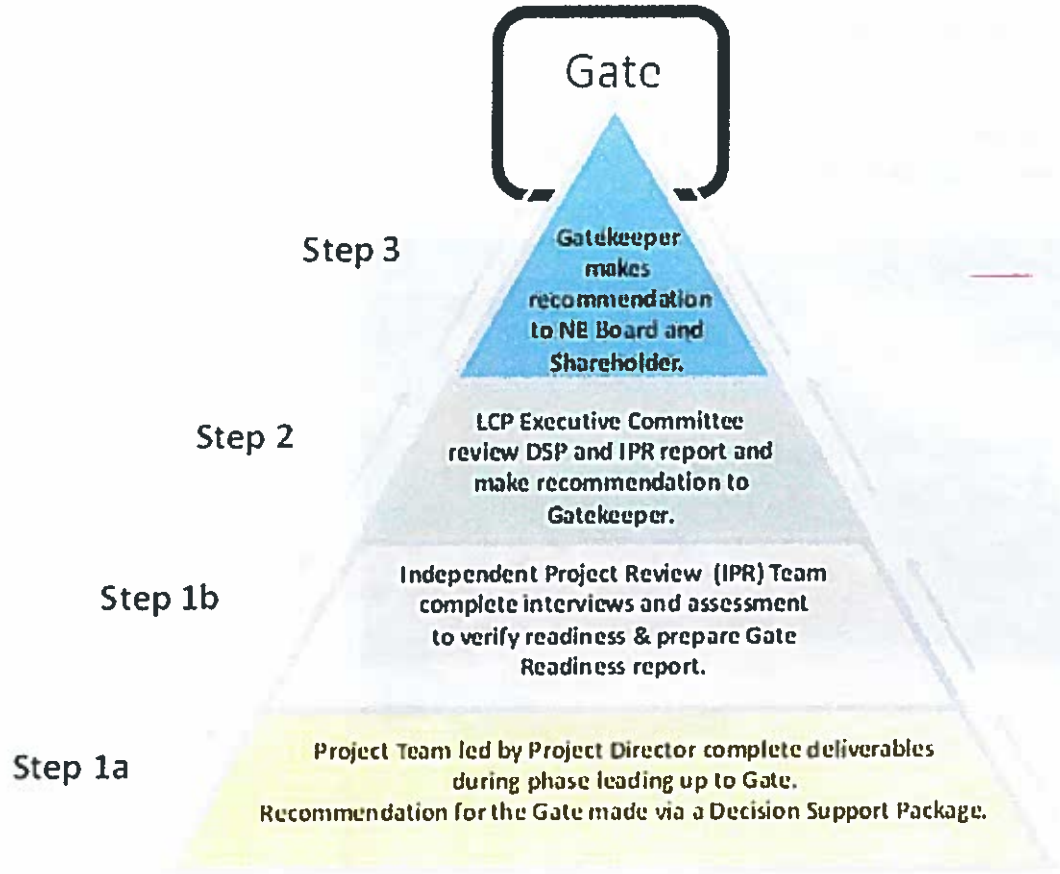
Nalcor's Stage-Gate Process

Structured, front-end loading process that enables risk-informed decision making at Decision Gates by completing critical analysis in the Phase leading to the Decision Gate, while ensuring a balance of analysis with capital pre-investment .



- The Stage gate process is an industry standard and best practice for large projects.
- In order to pass through a Gate there are checks and balances that must be met by the Project Team, an Independent Project Review team, the Executive Committee and finally the Gatekeeper who makes a recommendation to the Board and Shareholder (GNL)

Decision gate process



- The Gate 3 decision gate (DG3) process involved more than the Project team
- Inputs to the Decision Support Package were required to be supplied by other teams including IPR, Investment Evaluation, System Planning, Environmental, Aboriginal, NLH and GNL
- The Project team were responsible for approximately 74 key deliverables

The DG3 Support Package is documented in LCP: 200-010141-00007

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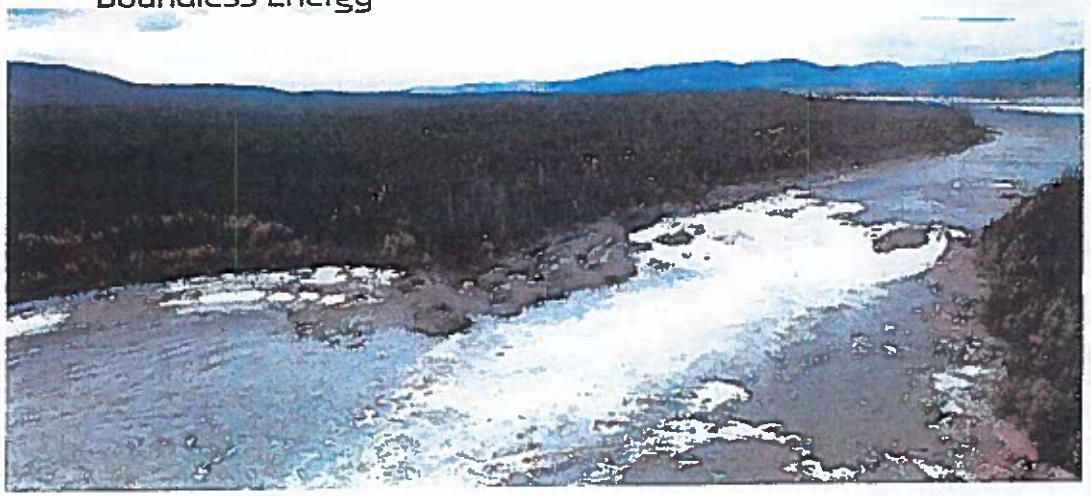


Nalcor Energy - Lower Churchill Project Phase 1
Decision Gate 3 Support Package

November 2012
LCP Admin Rec No: 200-010141-00007

The DG3 DSP contained several key topics (1/2)

1. **Executive Summary** - the Purpose, Background and Structure of the DSP
2. **Recommendation to the Gatekeeper** – including the sign off of the steps leading up to the DG3 recommendation by Project Team, the IPR, the LCP Executive and all VP's.
3. **Load Forecast** - provided the interconnected island alternative data which predicted steady growth in electricity demand and a market sufficient to justify developing the MF generation facility
4. **System Planning Criteria and Need Identification** - which considered the generation and transmission planning criteria, reliability, Strategist and CPW analysis which led to needs analysis and the identification of the need for both transmission and generation
5. **Capital Cost** - which dealt with the LCP cost growth from DG2 to DG3, capital cost estimate process, also included was the Isolated island capital cost progression since the initial cost reports were commissioned
6. **Isolated Island Alternative** – which considered the least cost generation expansions in Strategist, Cumulative Present Worth (CPW) analysis and Holyrood operations in the isolated island case plus the potential un-costed risk of a carbon tax in the future

The DG3 DSP contained several key topics (2/2)

7. **Interconnected Island Alternative** – which considered the MF plus transmission case
8. **Cumulative Present Worth Analysis** - CPW and sensitivity analysis, including a 25% increase in capital cost which was believed to address strategic risk
9. **NLH's Regulated Revenue Requirements and Overall Wholesale Rate Analysis** - which considered NLH's long term forecast for its annual regulated revenue requirements and how this was used to develop wholesale rates for consumers
10. **Conclusion** – based on the analysis a recommendation to the Gatekeeper to approach the Board and proceed with the interconnected island alternative
11. **Appendices** – included the MHI report, the Project deliverables status, Planning Load Forecast, Generation planning issues report, Meteorological Analysis, LCP capital cost overview, Hatch wind study, NLH wind integration study, Retail Rates analysis.

Estimate and Schedule

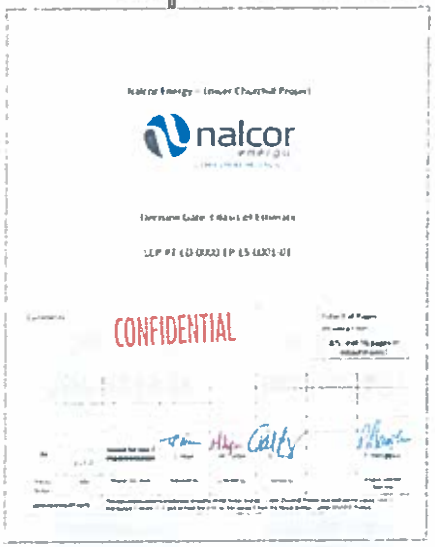
Key deliverables of DG3 estimate

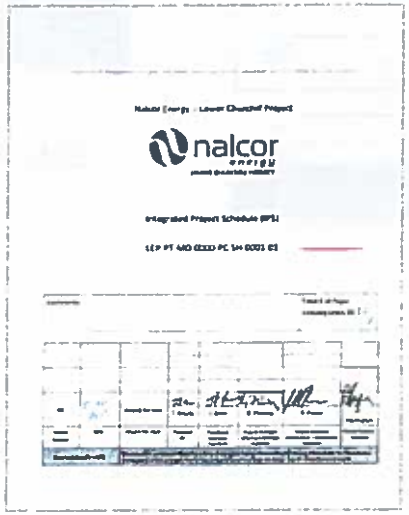
At the time of preparation of the estimate there was confidence in the capital cost that resulted, because:

SNC Data	▪ SNC were responsible for the parts of the estimate that included the main contracts and labour component i.e. ~70% of the estimate amount and SNC claimed they had the most contemporary data on contract and labour costs of hydro and transmission work carried out in cold climates
Estimating Resources	▪ Experienced estimating resources were formed into an integrated team to develop the DG3 estimate
Escalation Model	▪ The development of an escalation model using specialized consulting companies
Third Party Checks	▪ The estimate review and check process including Validation Estimating (J Hollman) Manitoba Hydro International (MHI) DG3 review, the Third Party Check Estimates (Mulcahy and Hewitt) and Power Advocate
QRA	▪ A cost and schedule QRA was carried out as recommended by AACEI to determine the Tactical Risk exposure and Strategic Risk exposure (Project Contingency and Management Reserve)

The estimate was based on the best information available at the time

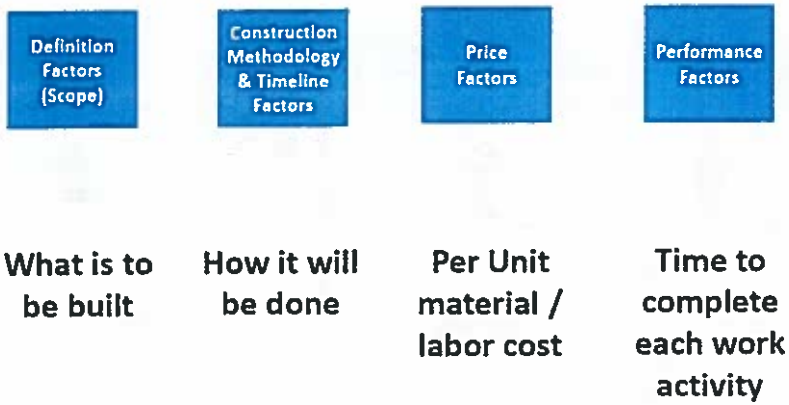
The DG3 Capital Cost Estimate and schedule are comprehensively described in documents:





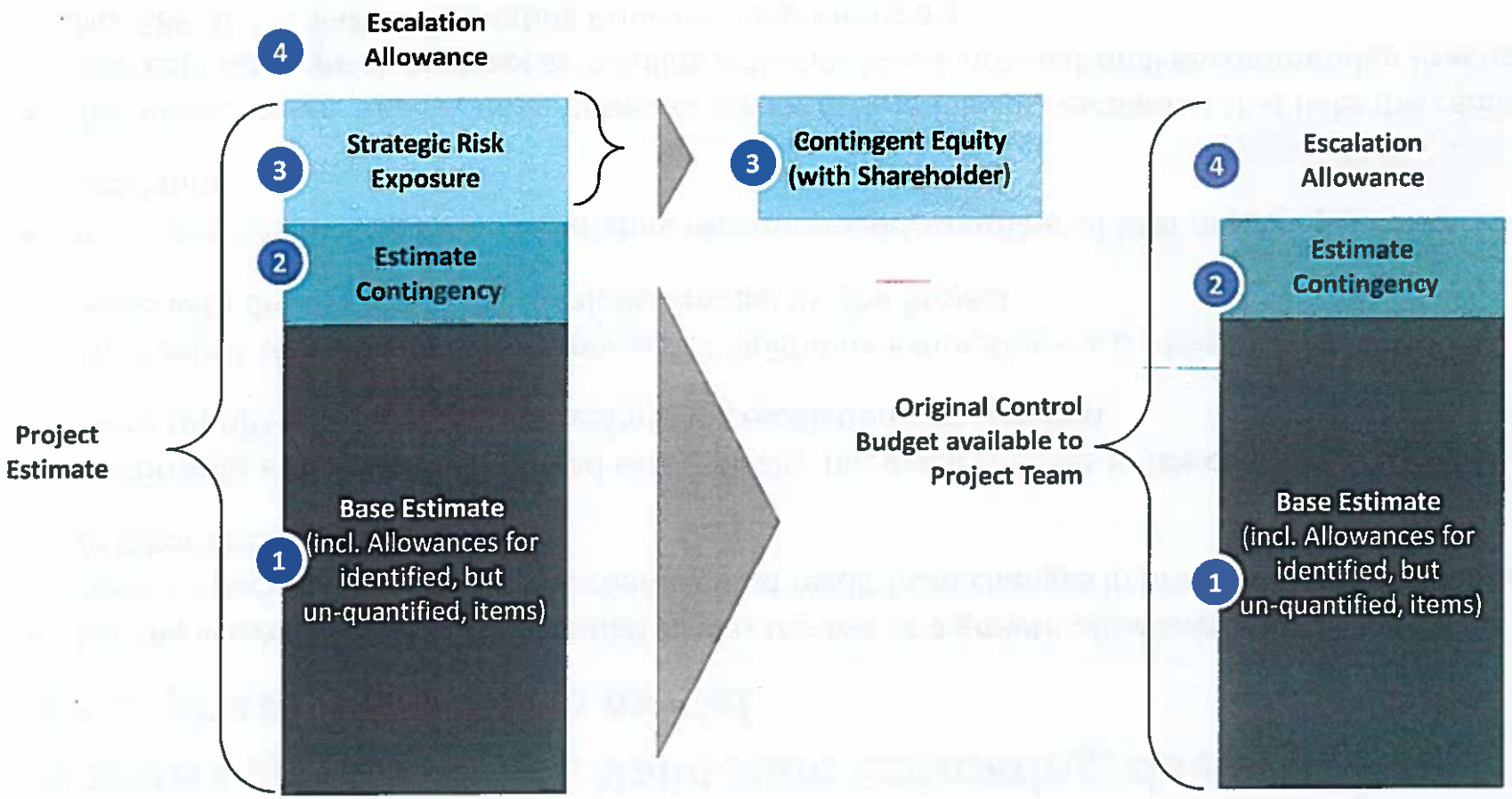
Elements of an estimate

The Estimators Consider 4 Elements



WBS number	Sub-Section	Physical Element	Estimate Responsibility	Bid Price to be Available
3000		Powerhouse & Related Structures		
3100		Tailrace - General		
	3101	Phase 1, Tailrace Rock Plug	SLI	No
	3102	Phase 1, Powerhouse Excavation	SLI	No
3200		Intake & Penstock - General		
	3220	Concrete Intake Structure	SLI	No
	3230	Intake & Spillway Interface Structure	SLI	No
	3240	Intake Gates, & Trash racks	RFP	Budgetary
	3250	Concrete Intake Penstock Structure	SLI	No
3300		Powerhouse & Related Structures		
	3310	Concrete Powerhouse Phase 1	SLI	No
	3311	Concrete Powerhouse Phase 2	SLI	No
	3320	Superstructure (Structural & Architectural)	SLI	No
	3330	Draft Tubes Gates & Hoist	SLI	Budgetary
	3360	Powerhouse Crane Equipment	SLI	Budgetary
	3361	Powerhouse Elevators Equipment	SLI	Budgetary
3400		Turbine & Generator		
	3410	Turbine	SLI	Yes
	3420	Generator including excitation system, control & protection	SLI	Yes
	3440	Electrical Ancillary Equipment	SLI	No

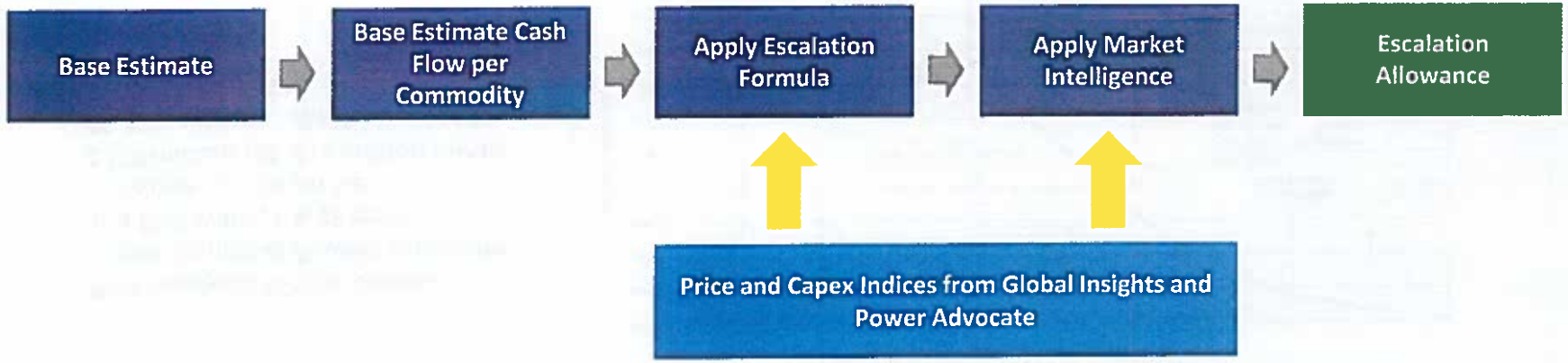
Cost estimate is broken down into 4 parts



A third party company, Validation Estimating, developed a time-phased escalation model

- For the Muskrat Falls Project, escalation was treated as a growth allowance against each contract package to address cost changes that result from changes in price levels (e.g. fuel price or labor price increases)
- Historically, escalation was treated simplistically, but given changes in the economic climate a more sophisticated approach to estimating escalation was required
- The Project team engaged the services of Validation Estimating – a US-based consultancy to assist with developing a cost escalation model for the Project
- In its assessment, Validation Estimating recommended a number of best practices for cost escalation
- The Project team developed a methodology for estimating cost escalation that links the capital cost estimate with the project scheduling activities (AACE International Recommended Practice No. 58R-10 Escalation Estimating Principles and Methods)
- Validation Estimating has provided services to numerous large companies, including Aramco, BP, Manitoba Hydro, Ontario Power, Petro-Canada, Rio Tinto Alcan, and Suncor among others

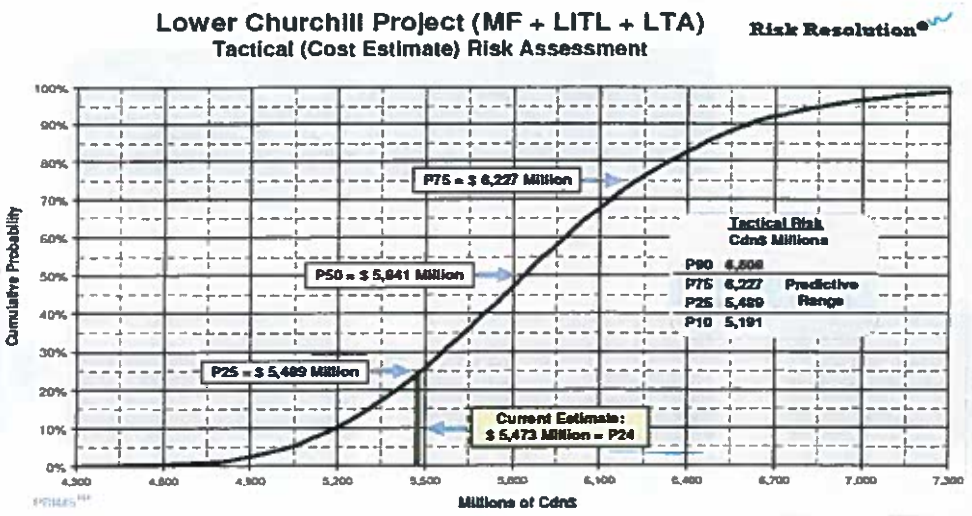
Inputs that make up escalation



The tactical cost risk contingency was calculated as 7 % of the estimate

Tactical Risk Analysis Results – Lower Churchill Project

Risk Analysis for the overall Lower Churchill Project suggests, at a P50 value, the project contingency would be $368 million ($5,841 million minus $5,473 million), which equates to 7% of the estimate.



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Tactical cost risk contingency summary: 7% of estimate and $368 million at P50

Summary

An estimate accuracy analysis was performed for the Lower Churchill Project. This involved select interviews with knowledgeable project team personnel, a review of the estimate, and a Tactical Risk Assessment on the estimate. For the Tactical Risk Assessment, project team members developed Best and Worst cases for each of the estimate items considering all identified risks around the estimate. The Best and Worst case values were used to develop probability distributions consistent with each item's risk profile. A Monte Carlo simulation was then performed using the PRIMS™ model and Crystal Ball software.

The Tactical Risk evaluation was based on the current adjusted estimate of $5,473 million (excluding the contingency). This "Base Estimate" is stated in January 2012 Canadian dollars.

The scope for the project is well defined and represents design development consistent with project sanction. Considerations, such as likely geotechnical conditions and quantity variations due to further design development, were quantified based on the experience of the project team and used as a basis for assessing the possible outcomes.

The estimate and quantification are consistent with the requirements of project sanction. In many cases, pricing was based on actual bids and budgetary quotes. "Check" estimates were developed by industry experts for key areas, including the Muskrat Falls powerhouse and dam works. Other pricing was benchmarked against representative projects. The effects of weather, labour/skills availability, and supervision were also considered and/or benchmarked. Overall, this project's degree of design development, definition, and methodology is consistent with an AACEI Class 2 estimate.

The estimate, plus an amount to reach the P50 on the results curve, should represent the cost at which the project can be executed according to the plan exclusive of external uncertainties.

A P50 contingency is $368 million which equates to 7% of the estimate.

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Strategic cost risk contingency summary: Management Reserve

External / Strategic Risks Beyond Estimate Contingency

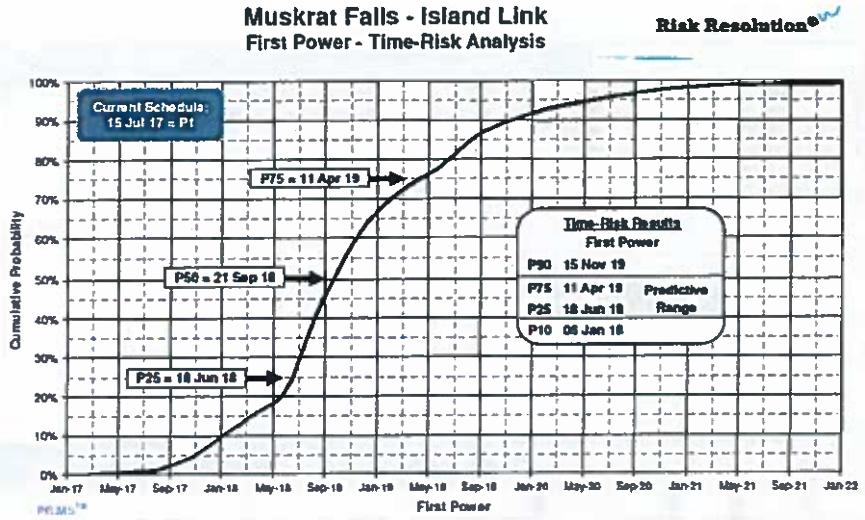
Performance Risk Exposure	The performance rates /norms and indirect estimates used in the estimate, including the estimate contingency, are based upon historical performance for similar hydro-projects and are predicated upon achieving the envisioned labor strategy and are much better than what is being experienced in Long Harbour (restrictive work practices). Contractor mark-ups for unit price agreements could be excessive if there is a perception risk that the labor strategy will not materialize. Experienced front-line supervision, a key to performance, is now a world market and will likely experience high demand during this project.
Competition for Resources	The estimate for MF is based upon the labor rates in the Hebron Agreement. Given that the total project has approx. 18 million person-hours of labor requirements (including Owner + PMT + Services), it is likely to compete with Western Canada for labor. The wages used for estimating are slightly lower than Western Canada, but NL has larger union premiums resulting in lower take-home compensation. In addition completion bonuses are planned for Western Canada. Escalation allowance assumes between 3 and 3.5% annual increase in labor cost.
Schedule Risk Exposure	There is a potential time or schedule risk exposure for beyond the plan due to the weather and volume of work in the powerhouse. The current schedule for MF assumes achievable performance in the powerhouse concrete, however the sustainability of the required production rates for placement of the ~460,000 m3 of concrete through-out several winters will be challenging. Maintaining an October 2012 start of Bulk Excavation is considered critical to maintain the overall program.

Schedule risk analysis was largely driven by MFG

Risk Adjusted Schedule Suggests an 11 to 21 Month Delay for First Power

Results are still largely driven by timing of Muskrat Falls Generation Facility. Major risks for facility are:

- *timely placement of concrete in powerhouse*
- *ability to place cofferdams and RCC dams while avoiding flooding*
- *availability of labour, skills, and front-line supervision*



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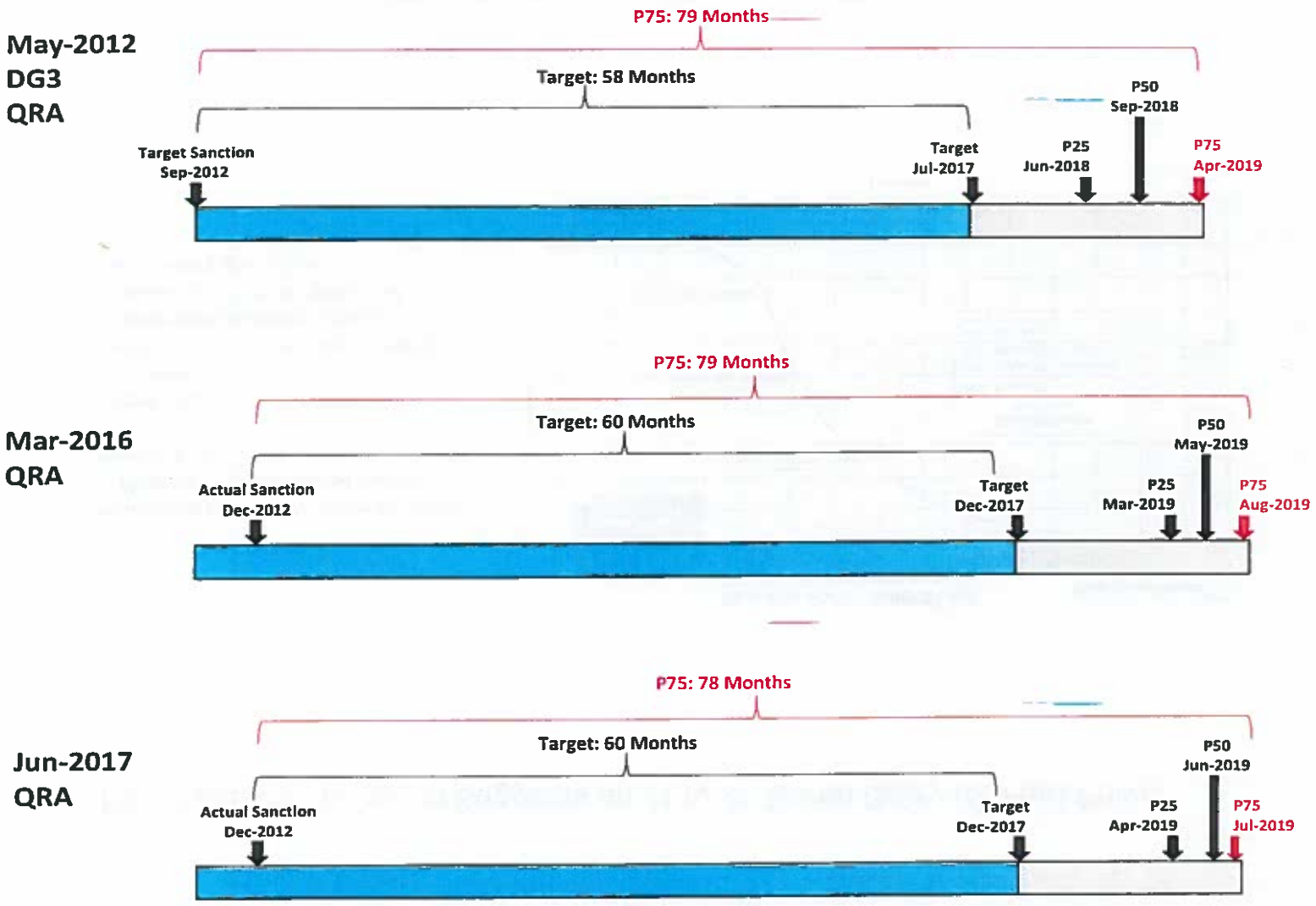
Comparison of P75 schedule versus target



The DG3 estimate accuracy was in line with AACEI Class 3 range

- The Project team adopted the recommended estimating practices of the **Association for Advancement of Cost Engineering (AACE) International**
- While AACE International has yet to publish a cost estimate classification system, the Project team built upon the general guidance contained within Recommended Practice No. 17R-97 to map the level of estimate maturity required for each of the gate decisions within the *Gateway Process*
- The accuracy of the cost estimate was expected to mature along a continuum, with a quantitative assessment of accuracy made using QRA techniques.
- The DG3 QRA later revealed that the capital cost estimate, exclusive of Estimate Contingency, and with no consideration of strategic risk and time exposure, was believed to have an **accuracy (P10/P90) in the range of -5% to +21%,** which is within the expectations of the targeted Class 3 estimate required for Decision Gate 3.
- This indicates that there was a 1 in 10 chance that the estimate, exclusive of materialization of strategic risk, will exceed +21% beyond the Base Estimate of $5,472M equating to some $6.6B (exclusive of escalation and strategic risk exposure)

The DG3 (P10/P90) estimate accuracy of -5% to +21%, was in line with AACEI Class 3 range

Required for	Decision Gate 1	Decision Gate 2	Decision Gate 3	Financial Close	Mid-Point Check
Class	AACEI Class 5	AACEI Class 4	AACEI Class 3	AACEI Class 2	AACEI Class 1
Estimate Purpose	Opportunity Screening	Alternative Selection	Sanction / Control	Financing	Check Estimate
Project Definition	0% to 2%	1% to 15%	10% to 40%	30% to 70%	50% to 70%

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