Q. **Reference: Evidentiary Update, Table 1, Page 3**

The Bates White Phase 2 Expert Report observes that the CAMS Review of the Avalon CT, which is included as Appendix A in that report, indicated that management reserves are not typically seen for projects of this type. Hydro's March 12, 2026 response (Page 12) to Bates White states "*For large capital projects such as the Avalon CT, establishing a Management Reserve supports overall project risk tolerance by providing a mechanism to respond when unforeseen issues arise, and timely action is required to avoid additional cost or schedule impacts. The inclusion of Management Reserve to address strategic risks at a confidence level of P85 is also consistent with the findings and recommendations of the Muskrat Falls Inquiry.*"

a) Please reconcile CAMS's position that management reserves are not typical for projects of this type with Hydro's position that one is needed.

b) Did Hydro request a management reserve for its existing Holyrood CT and how did that project's risk and complexity differ from that of the Avalon CT?

c) Other than for the citation of the Muskrat Falls Inquiry to use a P85 estimate what other reasons are there for such a large management reserve?

A. **a)** Newfoundland and Labrador Hydro ("Hydro") is unable to address the specificity of CAMS' position without knowing the contextual factors of the projects that CAMS used in its analysis, including jurisdictional considerations, the project proponents, project developer type (public versus private), or location (region). Hydro's processes are consistent with industry guidance and recommended practices for Major Project execution, as published by the Association for the Advancement of Cost Engineering ("AACE"), in particular. Hydro's approach with respect to management reserve has also been validated by a risk and estimating subject matter expert, Mr. John Hollmann of Validation Estimating.

Some organizations choose to fund project reserves at higher values (P70, P80, P90) but use different terms than management reserve, sometimes calling it a P80 contingency,[1] for example. Regardless of nomenclature, the intent is consistent- it is the funding amount necessary to achieve a given probability of project underspend. A major difference between contingency and management reserve is in the governance and control mechanisms put in place to manage and control its use.

Contingency is an amount intended to cover known unknowns as well as some amount of expected risk events with nominal impact. This amount is added to an estimate to allow for items, conditions, and events for which the outcome is uncertain and that experience shows will likely result in additional cost. Larger, more strategic risks, were they to occur, could individually consume much of the contingency budget. It is these more strategic risks which normally account for the "management reserve" and are included in the Monte Carlo simulations.

Industry guidance, expert experience and knowledge of major projects deem it most prudent to consider these types of risks in estimating. In a complexity assessment completed by Hydro's Internal Audit department using methodology from the Project Management Institute ("PMI"),[2] the Avalon Combustion Turbine ("CT") project scored an 81 of 115 and was rated very high complexity. Therefore, given the complexity of the Avalon CT project and its status as a major project when compared to the projects included within the Hydro annual capital program, such treatment is warranted. The Project Complexity Matrix is provided in Table 1.

[1] "Dispatchable Capacity Project – Brandon Generating Station – 3 New Units," Manitoba Hydro, April 29, 2026, https://www.hydro.mb.ca/docs/regulatory_affairs/pdf/other_regulatory_matters/irp_mnf_review/02-5_a_basis_of_estimate_generating_station.pdf.
[2] "Navigating Complexity: A Practice Guide," Project Management Institute, March 2014.

Table 1: Project Complexity Matrix

Complexity	Complexity Score (Range)	Project Size	Budget	Requires PUB Approval
Extreme Complexity	95-115	Mega Project	>=$1B	Yes
Very High Complexity	75-94	Major Project	>=$500 M<$1 billion	Yes
High Complexity	35-74	Large Project	>=$50 M <$500 M	Yes
Medium Complexity	25-34	Medium Project	>=$750 thousand <$50 M	Yes
Low Complexity	10-24	Small Project	<$750 thousand	No
Very Low Complexity	0-9	Simple Project	<$50 thousand	No

In a memo prepared for Hydro, provided as CA-NLH-023, Attachment 1, Mr. John Hollmann, an estimating and risk Subject Matter Expert[3] noted that:

> What drives the need for MR [Management Reserve] for major or strategic projects that have material importance to company overall capital performance is simply that it would be imprudent to risk the stockholder's or rate or tax payer's economic well-being on the equivalent of a 50/50 coin toss (i.e., most set contingency at the p50 or median of the cost distribution) using a coin that is weighted to come up tails (high cost). Underruns are bounded; overruns are not. Unlike with a portfolio of small projects, there is no balancing of under and overruns with major projects. It is not uncommon for overruns on mega projects to drive owner's credit rating into junk bond territory and/or drive down share price due to write downs or write-offs. Public agencies suffer a loss of credibility and confidence (e.g., Muskrat Falls and Site C).[4]

In this same memo, Mr. John Hollmann notes:

> Unfortunately, most companies and agencies do not disclose project risk funding mechanisms and amounts publicly. Public infrastructure budgets often aggregate cost risks funding under broad, ambiguous categories (e.g., "contingency allowance" that may or may not include MR equivalent). … Most public filings report "contingency allowance" or similar which is defined ambiguously as covering uncertainties, risk, and uncertainties, or known-unknowns which is inconsistent with AACE's "expected to be expended" intent (i.e., p50 or mean). Regardless of what the cost risk account is called, many agencies do require probabilistic QRA and they do publish the expected

[3] Mr. John Hollmann is the lead author of the AACE International Total Cost Management Framework and primary contributor to many of the AACE estimating and risk Recommended Practices published by AACE. Please refer to www.validest.com/qualifications for further details about Mr. John Hollmann's qualifications as a Subject Matter Expert in estimating and risk.
[4] Hollmann, J. K., *"Management Reserve,"* Validation Estimating LLC, November 18, 2025, pp. 4–5.

> confidence level upon which to base overall funding. …Most US and Canadian agencies report using confidence levels in the p70 or p80 range, but again, most use ambiguous terms like contingency allowance as to how this value is accounted for in project budgets.[5]

Mr. John Hollmann goes on to state:

> …the methods for quantifying, reporting, and funding of cost risks are poorly documented in public reporting and literature. However, what is published suggests that most apply probabilistic risk analyses and fund or at least consider costs at a higher confidence level than the median or mean (e.g., in the p70 to p90 range) for major projects.[6]

In summary, while CAMS' observation reflects that management reserve is not universally applied across all projects, Hydro's approach is intentionally aligned with the specific context of the Avalon CT as a large, complex, and strategically significant project. Hydro considers it prudent to fund cost risk at a higher confidence level, rather than relying solely on median-based contingency, to appropriately manage uncertainty and protect ratepayers from material cost exposure. Hydro's proposal of an authorized cost at P85 ultimately achieves the same overall budgeting result as assigning a higher contingency allowance to achieve a higher confidence level. However, Hydro's inclusion of a management reserve applies more stringent governance and criteria for use than a traditional contingency allowance. With sufficient governance, the inclusion of management reserve does not raise the actual cost of the project, as its funds are utilized only if strategic risks are realized. Conversely, the exclusion of management reserve poses risk to actual project costs, namely the cost and schedule risk associated with the regulatory process to evaluate and approve cost increases, should strategic risks become realized. This approach is consistent with industry-informed risk management practices and guidance received directly from a leading industry subject matter expert, and reflects lessons learned from past major projects, supporting the inclusion of a management reserve as a necessary and appropriate component of the overall project funding framework.

[5] Hollmann, J. K., *"Management Reserve*," Validation Estimating LLC, November 18, 2025, p. 6.
[6] *Supra*, f.n. 5.

b) The existing Holyrood CT was approved by the Board of Commissioners of Public Utilities in Order No. P.U. 16(2014) in May 2014, following an application in April 2014. This was an expedited application and Hydro's estimating practices at the time of this application did not include qualitative risk assessments or requests for management reserves. As such, the existing Holyrood CT did not include management reserve.

In the decade since the Holyrood CT project, there have been many developments that have influenced Hydro's current practices. The outcomes of the Muskrat Falls Inquiry informed how large public projects should be prepared and developed in Newfoundland and Labrador. Additionally, there has been significant industry research into the execution and outcomes of major projects through organizations such as AACE, PMI and the Construction Industry Institute, and the guidance has matured to reflect the actual outcomes on major projects.

While the Holyrood CT project was a complex project with material risk, there are several differences between the existing Holyrood CT and the proposed Avalon CT project. The existing CT project was able to be located on an existing Holyrood site that was already partially prepared. Additionally, there was room in the existing terminal station, and no major transmission line work was required. This is not the case for the proposed Avalon CT project. The Avalon CT project requires a new, large switchyard and significant transmission line work to both relocate existing lines and tie in new lines. The Avalon CT project also includes a three-unit package, requiring additional support systems, infrastructure, and powerhouse requirements, as opposed to the existing CT, which was a single unit. The Avalon CT project also includes more fuel storage than the existing Holyrood CT. The additions noted here require extensively more civil works on a greenfield site, which adds greater complexity and uncertainty. The cost estimate for the proposed CT project reflects Hydro's improved estimating practices as well as the higher complexity and uncertainty of the proposed Avalon CT project.

c) The Muskrat Falls Inquiry specifically recommended the funding of "… large projects using a probability value of not less than 85%."[7] Notwithstanding this recommendation for publicly funded projects, Mr. John Hollmann noted in his memo that:

> …the prevalence of cost overruns on major projects, particularly in infrastructure (e.g., Muskrat Falls (MF) Inquiry and Site C Lessons Learned) has raised interest in MR as part of a solution to address tail risk in estimates. In the cost, schedule and risk technical communities, the distribution of actual cost growth and schedule slip are well known to be approximately lognormal; i.e., unbounded on the high end.[8]

Mr. Hollmann also noted that "General reserve is usually funded at the p70, 80 or 90 percent confidence level on major projects depending on the company management's or agency's capital cost risk tolerance."

The need for a management reserve set at a higher level reflects the risk tolerance of Hydro to be able to manage, control, execute and deliver major projects. Without sufficient project funding reserves, and following existing regulatory processes for capital budget increases, Hydro would be constrained in its ability to access necessary funding in a timely manner to seize opportunity or to mitigate further cost impacts should a significant risk materialize.

[7] "Muskrat Falls: A Misguided Project, Commission of Inquiry Respecting the Muskrat Falls Project," The Honourable Richard D. LeBlanc, Commissioner, March 5, 2020, vol. I, Key Recommendation 5, pp. 61–62.
[8] Hollmann, J. K., *"Management Reserve*," Validation Estimating LLC, November 18, 2025, p. 2.

Date: November 18, 2025
From: John K. Hollmann, CCP CEP DRMP; Owner, Validation Estimating LLC (Consultant)
To: Tony Scott, Newfoundland and Labrador Hydro (Hydro)
Subject: Management Reserve

This memo provides the Consultant's comments on Management Reserve (MR). Hydro expressed interest in the following: *What is the intention of Management Reserve?; what is the need for MR?; is MR use common?; is MR use considered best practice?; are there any MR case examples by Canadian utilities that can be shared?*

CONSULTANT'S COMMENTS

Any discussion starts with understanding the terminology.

Definitions

The following are excerpts from AACE International (AACE) Recommended Practice (RP) 10S-90 *Cost Engineering Terminology*:

Management Reserve (MR) is "*an amount added to an estimate to allow for discretionary management purposes outside of the defined scope of the project, as otherwise estimated. May include amounts that are within the defined scope, but for which management does not want to fund as contingency or that cannot be effectively managed using contingency.*"

MR by the definition above is distinct from Contingency which is defined in 10S-90 as follows:

Contingency is *"an amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs. Typically estimated using statistical analysis or judgment based on past asset or project experience. Contingency usually excludes:*

a. *Major scope changes such as changes in end product specification, capacities, building sizes, and location of the asset or project;*
b. *Extraordinary events such as major strikes and natural disasters;*
c. *Management reserves; and*
d. *Escalation and currency effects.*

…Contingency is generally included in most estimates and is expected to be expended."

Background

The following provides context on the industry situation related to tail risk and MR and how AACE International, the preeminent association regarding project cost and schedule risk quantification, is addressing it. AACE does not use the term "best practice" ("best" can only be defined within a context), but its "Recommended Practices" (RPs) represent practices that have been demonstrated as reliable.

Tail Risk and Overruns

In recent years, the prevalence of cost overruns on major projects, particularly in infrastructure (e.g., Muskrat Falls (MF) Inquiry[1] and Site C Lessons Learned[2]) has raised interest in MR as part of a solution to address tail risk in estimates. In the cost, schedule and risk technical communities, the distribution of actual cost growth and schedule slip are well known to be approximately lognormal; i.e., unbounded on the high end[3] (i.e., highly skewed) and therefore contingency, which by definition is "*expected to be expended*" (and therefore based on the mean or expected value of distributions) is inadequate to represent a highly skewed project risk profile.

Management Reserve (MR) and AACE

The definition and use of MR have long been recognized in the AACE technical community. For example, RP 104R-19: *Communicating Expected Estimate Accuracy*[4], states: "*depending on a specific organization's policies, management reserve may be added to the value of the base estimate or the value of the base estimate plus contingency. When determined effectively, the end use value addresses uncertainty and risks considering stakeholder risk tolerance and confidence levels.".* Other RPs and Professional Guidance Documents (PGDs) addressing MR include but are not limited to 34R-05 on Basis of Estimate, 70R-12 on schedule contingency, 100R-19 on Contract Change Management, 137R-25 on Owner's Cost, PGD-02 Guide to QRA, and RPs in progress on Owner Change Management and on Contingency Management. MR is also described in AACE transaction papers going back at least as far as 1988.

As will be discussed, an RP to address communication clarity was needed because most outside the technical community (management and stakeholders such as regulators) have not understood these statistical concepts and definitions. For further clarity, the AACE Decision and Risk Management (DRM) technical subcommittee is developing a new RP (unnumbered) to be entitled: *Management Reserves: Principles, Analysis and Management Considerations* (RP scoping document attached).

High impact low probability (HILP) risks

A related topic regarding tail risk and MR is *high impact low probability (HILP)* risks. Per the RP 10S-90 contingency definition, HILPs correspond to the noted contingency exclusion (therefore a focus of MR): "*extraordinary events such as major strikes and natural disasters*". For clarity, the AACE DRM technical subcommittee is also working on another new RP (unnumbered) to be entitled: *High Impact/Low Probability (HILP) Risks: Considerations for Identification, Qualitative Analysis and Treatment* (RP scoping document attached). That RP is planned to define types of management reserves including "general" to address risk tolerance (in respect to the natural skewness of cost outcomes) and "specific" for HILP risks that "*cannot be effectively managed using contingency*" per RP 10S-90.

---

[1] Commission of Inquiry Respecting the Muskrat Falls Project, *Muskrat Falls: A Misguided Project*, March 5, 2020.
[2] BC Hydro, *Site C Project Lessons Learned Report to Inform Future Major Capital Projects*. October 30, 2025.
[3] John Hollmann, *Project Risk Quantification*, Volume 1 (2016) and Volume 2 (2024).
[4] To aid communication, excerpts from RP 104R-19 are appended to all the AACE Estimate Classification RPs including for Hydropower and Transmission projects.

HILPs cannot be effectively managed with contingency because the premise of contingency is that it is an amount that will cover general uncertainty plus the overall impact of the occurrence of some fraction of many potential risk events of nominal impact (i.e., day-to-day or "expected" risks). HILP risks may individually consume much of or all of contingency (or more) in a near instant. Funding all or some part of the potential impact of one or more HILPs within contingency puts excessive (i.e., not expected to be needed) funds under the authority of the project manager. One expects disciplined cost management on the front line, but experience shows that contingency tends to be spent; excess contingency funding removes a cost discipline incentive.

Note that both the Muskrat Falls (MF) Inquiry and Site C Lessons Learned reports speak to the need to address HILPs (i.e., one aspect of "strategic risks" in the Muskrat Falls report) through MR or equivalent funding or at least communicating their potential impact to decision makers.

Communication Challenges and Mixed Usage of Management Reserve

The risk technical community as represented by the AACE DRM subcommittee is aligned on at least general MR for risk tolerance on major projects. That is less true for the non-technical community including management and stakeholders such as regulators. Business managers, who sponsor capital project investments, often coming from operational backgrounds, may view *contingency* as a type of "slush fund;" i.e., if the project managers do their job, they would not need this money.

In part the "slush fund" thinking reflects experience with small project systems (e.g., capitalized maintenance and sustainment portfolio projects[5]) with which operations people have familiarity[6]. Industry benchmarking shows that overestimate-and-underrun cultures prevail for small project systems (just get the asset back up and running safely with less worry about cost effectiveness) which results in their cost growth distribution being skewed to underrun (i.e., little to no need for contingency).

Another contributor to "slush fund" thinking is that the majority of industry quantitative risk analysis (QRA) is done using subjective methods that suffer from "optimism bias" (underestimated contingency). So, companies that do fund MR above the contingency for major projects, where MR is supposed to be needed less than half the time, find that some MR is getting consumed most of the time[7]. This results in lost trust in QRA methods and outcomes.

Therefore, suggesting funding over and above already suspect contingency is an anathema to some in business management, and to others such as regulators who notice or share that thinking. In addition, MR based on the tail of skewed distributions, if quantified realistically,

[5] Small projects are usually managed as a portfolio wherein the over and underruns of the constituent projects, each with symmetrical cost distributions, tend to balance out so that MR is generally not needed.
[6] The MR discussion here relates mostly to more complex, longer duration major or strategic projects defined as those with full-time dedicated core teams that tend to cost $25-50 million or more and where the individual project has material importance to company overall capital performance.
[7] In statistical terms, the p80 of unrealistic QRA is the p50 of reality. Put another way, companies that fund their projects at p80 confidence level find that 50 percent of them still overrun when only 20 percent of them should; the real p80 may be uneconomical.

may result in an uneconomic project calling for spending more effort and time on value and risk management; resources and time that are typically scarce.

Another reason why some do not fund MR is given by the Australian Risk Engineering Society (RES) in their *Contingency Guideline*, 3rd edition 2025" which says: *"MR..is rarely set aside in the private sector as many consider the organisation would provide extra funding at the request of the project management team if circumstances require."* It should also state provide *in a timely manner*. That implies a culture of trust and an alignment of objectives. As will be discussed, trust that funds will be readily available in a timely manner is less common in the public, more political sector[8,9].

Another communication and assessment challenge has to do with HILPs. Many use philosophical or theoretical terms to describe these risks; in particular "unknown-unknowns." This terminology implies that HILPs are not worth worrying about, let alone quantifying. In the Consultant's experience, most teams avoid discussing HILPs for fear of being seen as pessimistic; hence project "risk registers" and later risk quantification exclude HILPs. In reality, the record shows that most major and essentially all mega projects of longer durations will experience multiple risks of this nature[10].

In short, many companies have ended up not countenancing MR or do not perceive the need for it, and much of my consulting since 2005 has been spent educating various clients on how short-sighted that usually is and how QRA practices need to be improved. The Consultant guesses that about half of Private Owner Companies are receptive of MR. The half with consistently large capital portfolios of complex strategic projects and with strong inhouse cost and risk competency will use MR, while the half with smaller, inconsistent capital budgets made up of mostly sustaining projects with the rare major project do not. Stakeholders including regulators that deal with both company types are left in between and may have mixed perceptions as to the need for MR.

As far as cost outcomes, the worst cases are smaller and/or newly created companies or joint ventures tackling one-off mega projects (e.g., Muskrat Falls and Site C) that do not have a good understanding of tail risk and the benefits of MR and thereby end up doing significant and lasting damage to their financial well-being and reputation.

Intention of and Need for Management Reserve

What drives the need for MR for major or strategic projects project that have material importance to company overall capital performance is simply that it would be imprudent to risk the stockholder's or rate or tax payer's economic well-being on the equivalent of a 50/50 coin toss (i.e., most set contingency at the p50 or median of the cost distribution) using a coin that is

[8] Funding decision delay is also common risk for private sector projects executed by joint ventures.
[9] It is a truism that delay, including in response to risk occurrence, is highly detrimental to project performance. Taking weeks or months to obtain approval for additional funds will result in more cost and potentially aggravate or compound risks (e.g., push work into more challenging seasons).
[10] For example, a complex major gas pipeline program the Consultant recently analyzed, wherein discussion of HILPs was invited, identified sixteen potential HILP risks, and five of them were funded with specific management reserve. The project is in progress and several of the HILP risks have occurred.

weighted to come up tails (high cost). Underruns are bounded; overruns are not. Unlike with a portfolio of small projects, there is no balancing of under and overruns with major projects. It is not uncommon for overruns on mega projects to drive owner's credit rating into junk bond territory and/or drive down share price due to write downs or write-offs. Public agencies suffer a loss of credibility and confidence (e.g., Muskrat Falls and Site C).

Some might argue that QRA, which realistically models the tail cost risk and funding MR or equivalent to address it will make a project proposal uneconomic or more challenging to get stakeholder or political support. This is a specious argument; the alternative is to invite economic failure (i.e., the weighted coin toss). If a project proposal fails to pass economic thresholds at higher cost confidence levels (e.g., p80 funded as MR or otherwise) at an investment decision point, the scope should be changed, risks mitigated, the project canceled, or other appropriate actions taken.

A confounding factor is the unfortunate reality that prevailing industry QRA practices are not empirically-valid (i.e., not based on the tail risk reality of actual project history) allowing optimism bias to prevail and making the need for MR less apparent. The Consultant's experience is that when empirically-valid QRA methods are used[11], the need for MR (at least the general risk tolerance type) is largely self-evident and no longer a question.

Recommended Practice

The upcoming AACE RP on MR will likely recommend applying two types of management reserve for major or strategic projects. They are general reserve for risk tolerance and specific reserve(s) for HILPs and similar.

General reserve is usually funded at the p70, 80 or 90 percent confidence level on major projects depending on the company management's or agency's capital cost risk tolerance. These confidence levels are applied to the cost distribution output of the QRA excluding HILP risks. The confidence levels for general MR are often set as capital project system policy.

Specific reserve(s) are based on quantifying the potential range of impact of each HILP risk uniquely, followed by an often-difficult management decision as to whether to fund them and if yes, how to do so. Given their individual low probability of occurrence, but collective higher probability, it is common to fund one or a subset of them as a prudent representation. Specific reserve(s) are in addition to the general reserve. Some choose to fund a single specific reserve for a group of projects. For both general and specific MR, authority for their use is at a designated management level above the project manager.

At a minimum, it is the responsibility of those performing QRA to identify and assess HILPs and to report the full, empirically-valid range (including the tails) of the risk profile. One is not doing any favors by ignoring HILP risks to make management decisions easier. It is the responsibility of management to at least report the full risk profile to stakeholders as appropriate.

[11] AACE Professional Guidance Document No. 2 (PGD-02), *Guide to Quantitative Risk Analysis* summarizes the recommended QRA methods (aacei.org/resources/professional-guidance-documents).

Examples of Management Reserve Usage

Unfortunately, most companies and agencies do not disclose project risk funding mechanisms and amounts publicly. Public infrastructure budgets often aggregate cost risks funding under broad, ambiguous categories (e.g., "contingency allowance" that may or may not include MR equivalent). Disclosure is limited to inquiry reports such as the Muskrat Falls Inquiry and Site C Lessons Learned reports, and those usually result from inadequate identification, quantification, and funding of risks by any mechanism.

Most public filings report "contingency allowance" or similar which is defined ambiguously as covering uncertainties, risk, and uncertainties, or known-unknowns which is inconsistent with AACE's "*expected to be expended*" intent (i.e., p50 or mean). Regardless of what the cost risk account is called, many agencies do require probabilistic QRA and they do publish the expected confidence level upon which to base *overall* funding. For example, the US Department of Energy funds its (often complex and high technology) projects at the 90 percent confidence level (p90) which is at the high end. Most US and Canadian agencies report using confidence levels in the p70 or p80 range, but again, most use ambiguous terms like contingency allowance as to how this value is accounted for in project budgets.

One 2024 case study co-authored by the Consultant covered the Manitoba Hydro (MH) Keeyask hydropower megaproject and its use of a "specific" management cost reserve (plus a schedule reserve buffer prior to commercial power commitment).[12] However, at the time MH did not use "general" MR to the project's detriment. MH now considers both general and specific MR in its QRA, however, what is reported to the provincial authorities is uncertain.

The Consultant performs cost and schedule QRA for most major projects for a Canadian gas and power utility and those analyses recommend general and specific MR. Again, how those cost risks are reported to the provincial authorities is uncertain. In recent years, all major project QRA analysis done by the Consultant for all clients include general and specific MR. On the other hand, the Consultant participated in an independent project review (IPR) of a Canadian hydropower megaproject for which the company failed to identify or quantify HILPs in its QRA.

In short, the methods for quantifying, reporting, and funding of cost risks are poorly documented in public reporting and literature. However, what is published suggests that most apply probabilistic risk analyses and fund or at least consider costs at a higher confidence level than the median or mean (e.g., in the p70 to p90 range) for major projects. That addresses general risk tolerance (e.g., general MR whether accounted as such or not). However, there is little evidence that many identify, quantify or fund HILP risks; most exclude so-called unknown-unknowns.[13] AACE is currently striving to improve practices and understanding regarding tail risk, HILPs and how best to fund and manage them, including the use of management reserves.

[12] John K. Hollmann and Raminder S. Bali, "Case Study: Use of the Hybrid Parametric and Expected Value QRA Method on the Keeyask Hydropower Megaproject," AACE Transactions, 2024.

[13] The Consultant does not use unknown-unknown or similar terminology. It is ambiguous, but also there are very few risks that have not occurred before on projects or that occurred and will not occur again. In the duration of a typical megaproject, there will be labor shortages, strikes, regulation changes, supply chain interruptions, pandemics, and so on. The risk descriptions may vary, but their impacts closely rhyme.

Conclusions/Summary

The following summarizes the Hydro questions about management reserve (MR) and the Consultant's comments that address them:

What is the intention of MR?

To make prudent capital investment decisions that appropriately recognize and fund the tail risk (cost growth that is significantly skewed to the high side) that is prevalent on major projects. Infrastructure project cost overruns are endemic. Separate MR risk funding also supports better governance (spending authority).

What is the need for MR?

Contingency (expected to be expended, i.e., the mean of the cost distribution), even if properly quantified, is inadequate to address the fact that cost growth on major projects is unbounded. Inadequacy is amplified if contingency is poorly quantified. Requesting supplementary funds after an overrun becomes evident on a project in progress often results in project delay with added costs, and diminished company or agency credibility and reputation (and credit ratings and share price in the private sector).

Is MR use common?:

Yes and no. "General" risk tolerance MR use is common at companies with significant major capital project portfolios. US and Canadian agencies report funding projects at higher confidence levels (e.g., p70 to p90) but are typically unclear about how risk funds are accounted for (e.g., ambiguous "contingency allowances" or other). Few companies or agencies yet fund high impact/low probability (HILP) risks through "Specific" MR or otherwise.

Is MR use considered best practice?

Yes, in context. AACE International, the preeminent association regarding project cost and schedule risk quantification, recognizes the use of general MR in its Recommended Practices (RPs). RPs on MR application and HILP risks are in progress to address specifics in appropriate context such as discussed in this memorandum[14].

Are there any MR case examples by Canadian utilities that can be shared?

There is a case study paper co-authored by the Consultant recounting the use of specific MR on Manitoba Hydro's Keeyask hydropower project. Both general and specific MR recommendations are included in every major project quantitative risk analysis (QRA) done by the Consultant, including for a Canadian gas and power utility and several provincial hydropower companies. However, how these utilities report costs to regulators is uncertain; risk funding specifics (e.g., account details) are generally not reported in public records or articles on cost overrun.

[14] The Consultant is a primary contributor to AACE International RPs on the topics of estimating and risk quantification, led the development of the Decision and Risk Management Professional (DRMP) certification, and is the author of the books *Project Risk Quantification*-Volume 1 (2016) and Volume 2 (2024).