

April 2014 Redacted

**MANITOBA PUBLIC UTILITIES BOARD  
NFAT REVIEW OF KEYASK AND CONAWAPA GS**



**KNIGHT PIESOLD INDEPENDENT EXPERT  
CONSULTANT SUPPLEMENTAL REPORT -  
CONFIDENTIAL**

**PREPARED FOR:**

Manitoba Public Utilities Board  
400 - 330 Portage Avenue  
Winnipeg, Manitoba R3C0C4

**PREPARED BY:**

Knight Piésold Ltd.  
Suite 1400 – 750 West Pender Street  
Vancouver, BC V6C 2T8 Canada  
p. +1.604.685.0543 • f. +1.604.685.0147

VA103-449/1-2  
Rev 0  
April 8, 2014

***Knight Piésold***  
**CONSULTING**  
[www.knightpiesold.com](http://www.knightpiesold.com)



ISO 9001 - FS 64926  
ISO 14001 - EMS 250121  
OHSAS 18001 - OHS 550122

**MANITOBA PUBLIC UTILITIES BOARD  
NFAT REVIEW OF KEYASK AND CONAWAPA GS**

**KNIGHT PIÉSOLD INDEPENDENT EXPERT CONSULTANT  
SUPPLEMENTAL REPORT - CONFIDENTIAL  
VA103-449/1-2**

<b>Rev</b>	<b>Description</b>	<b>Date</b>	<b>Approved</b>
0	Issued to PUB (Confidential Report)	April 8, 2014	<i>SRM</i>
A	Issued to the PUB in Draft form for review by MH for confidential material and factual inaccuracies.	February 18, 2014	SRM

***Knight Piésold Ltd.***  
Suite 1400  
750 West Pender Street  
Vancouver, British Columbia Canada V6C 2T8  
Telephone: (604) 685-0543  
Facsimile: (604) 685-0147  
[www.knightpiesold.com](http://www.knightpiesold.com)

***Knight Piésold***  
**CONSULTING**

**EXECUTIVE SUMMARY****Overview**

Through the intermediary of the Manitoba Public Utilities Board (PUB), the Government of Manitoba is carrying out a public Needs For and Alternatives To (NFAT) review and assessment of Manitoba Hydro's (MH's) Proposed Development Plan (Plan) which includes the Keeyask Infrastructure Project (KIP) and the Keeyask Generating Station Project (KGSP).

The PUB has engaged Knight Piésold Ltd. (KP) as an Independent Expert Consultant (IEC) to review the construction management and capital and operating costs for select resource options. KP filed an IEC Report on their initial review on January 23, 2014. The PUB has asked KP to review additional information in relation to the report and Manitoba Hydro's award of the Keeyask General Civil Contract early in 2014.

This supplemental report summarizes KP findings on the additional scope of work provided by the PUB on January 10, 2014. It does not include any further review of proposals for Conawapa. The content of this report is confidential and for the PUB only as it contains references to confidential material provided by MH.

**Item 1: Overall Management Strategy and Scheduling for the Tendering of Contracts for the Keeyask Generating Station.**

The overall management strategy and scheduling for the Keeyask Project is following a new process within MH. This has been explained to KP in the form of confidential documents and conference calls. The approach for the tendering of contracts is deemed to be comprehensive, well documented and applied, and the timing of the tendering appears to be on track. Since MH's systems are maturing there it was not possible to observe the full effectiveness of the management strategy at this time, there remains a notable systemic risk exposure associated with the project.

**Item 2: Construction Risk Management Strategy**

KP has reviewed MH's construction risk management strategy in the form of the Risk Management Procedure (whose purpose is to "detail the activities of planning, identifying, evaluating, responding, and monitoring for effective risk management as well as detailing the standard risk reporting templates..."), the Project Contingency Management Procedure, the 2014 Risk Analysis and Contingency Estimate by Validation Estimating and the Keeyask Project Risk Register.

The approach to construction risk management is industry standard and consistent with best practices, with specific roles and responsibilities associated with risk management in the overall management process. As far as can be seen, the risk management strategy is well set up and is being monitored and acted upon appropriately.

It can be assumed that at this stage of project development the technical risks have been addressed or mitigated. Having chosen a suitable, reputable and experienced company for the GCC contract, remaining construction risks are associated with contractor performance, in terms of quality, cost and schedule. Portions of the overall contingency have been allocated to the individual contracts to provide allowances to cover these risks.

[REDACTED]

**Item 3: Contract Documents for the Major Keyask Components**

Copies of various Keyask contract documents were made available to KP as part of the original scope of work and commented upon in the earlier KP report. The contracting method varies by project component but the principal civil works contracting strategy is an Early Contractor Involvement (ECI) Project Delivery Strategy. The contract documents and drawings that KP has seen have clearly been drawn up by experienced engineers, from within MH and from reputable experienced consultants and include appropriate performance incentives.

**Item 4: Construction and Equipment Procurement Bonding and Liquidated Damage Requirements**

MH has made available to KP details of the bonding or letter of credit requirements for a selection of the major Keyask contracts, in both the KIP and the KGSP. The amounts are based on risks associated with the individual contracts, past experience, and industry norms. These values are deemed by KP to be appropriate. Current practice is to strike a reasonable balance between protecting the interests of the owner and not paying an excessive premium for this insurance.

KP believes that the Liquidated Damages stated in the various contracts made available appear to be reasonable and in keeping with their purpose.

**Item 5: Quality Assurance and Quality Control (QA/QC) Requirements**

The most common arrangement for addressing quality in procuring hydroelectric power generating facilities is to make the Contractor responsible for Quality Control (QC) and the Owner (or his Engineer) responsible for Quality Assurance (QA). MH is conforming to this usual practice.

Quality Management in MH is specified at a high level in the various MH procedures and standards. These documents define the processes required in MH to establish and operate a quality management program, including a third main activity that takes place prior to QC and QA, Quality Planning (QP).

**Items 6: Overall Civil Contract(s) Project Management Approach**

The General Civil Contract (GCC) has been procured in an Early Contractor Involvement (ECI) process which provides an opportunity for MH and a selected contractor to work together to refine the contract. All aspects of the work, including design details, schedule, risk sharing and project management, are open for discussion. KP believes that this process reflects a genuine and appropriate opportunity for MH to optimise and bring as much certainty to the contract as possible. The KGSP contracts (including the GCC) have been and are being managed within a new project management system.

**Item 7: Pre-Tender Construction Estimates Compared to Actual Tender Prices**

MH has provided KP with summary presentation material and Bills of Quantities comparing the GCC proposals, the independent estimators estimate (by Chant), and an escalated original Engineers Estimate by KGS Acres. [REDACTED]

**Item 8: Expected In-Service Capital Cost for Keeyask**

Overall the Expected In-Service Cost for Keeyask has been prepared by MH with as much completeness as can be reasonably expected. The current estimate is no longer a bottom-up estimate as presented in 2009, but a blended estimate that includes awarded contracts. As a result of the GCC award the anticipated Direct Costs are deemed to be fairly accurate, when the risk portion is excluded. The Indirect costs include elements that were not fully described and as such are subject to possible escalation, but this amount should be reasonably captured through the project contingency.

MH was diligent in evaluating the project risk and translating these risks into monetary terms through the contingency and management reserve estimates. The risk associated with labour shortages and productivity, [REDACTED] all lead KP to believe that the Management Reserves will be fully utilized and that a larger Management Reserve may be desirable for a more risk adverse maker.

**TABLE OF CONTENTS**

	<b>PAGE</b>
EXECUTIVE SUMMARY.....	i
TABLE OF CONTENTS .....	i
1 – INTRODUCTION.....	1
1.1 PURPOSE AND FORMAT OF REPORT .....	1
1.2 APPROACH.....	1
1.2.1 Reporting and Outline .....	1
1.2.2 Source of Information (Manitoba Hydro).....	1
1.2.3 Limitations .....	1
2 – OVERALL MANAGEMENT STRATEGY AND SCHEDULING FOR TENDERING AND PROCUREMENT OF CONTRACTS.....	2
2.1 SCOPE OF WORK .....	2
2.2 MANAGEMENT STRATEGY FOR TENDERING .....	2
2.2.1 Hydro’s Management Strategy .....	2
2.2.2 Manitoba Hydro Documentation .....	2
2.2.3 Total Cost and Schedule Management (TCSM).....	3
2.2.4 Overall Tendering and Procurement Management Strategy .....	3
2.2.5 Contracts.....	3
2.2.6 GCC Early Contractor Involvement Process .....	3
2.3 SCHEDULING FOR TENDERING.....	4
2.4 EFFECTIVENESS OF TENDERING AND PROCUREMENT MANAGEMENT APPROACH.....	4
2.4.1 Minimizing Capital Costs.....	4
2.4.2 Securing Competitive Bids.....	4
2.4.3 Managing Construction and Procurement Cost Escalation .....	5
2.4.4 Managing Construction Risks .....	5
2.4.5 Procurement of other major facility components .....	5
2.4.6 Overall Assessment of Effectiveness .....	5
3 – CONSTRUCTION RISK MANAGEMENT STRATEGY .....	6
3.1 SCOPE OF WORK .....	6
3.2 RISK MANAGEMENT STRATEGY .....	6
3.3 EFFECTIVENESS .....	9
3.4 REVIEW OF THE RISK ANALYSIS AND CONTINGENCY ESTIMATE BY VALIDATION ESTIMATING.....	9
3.5 HIGH, LOW AND REFERENCE CASE .....	10
4 – REVIEW OF CONTRACT DOCUMENTS FOR MAJOR KEEYASK COMPONENTS.....	11
4.1 SCOPE OF WORK .....	11
4.2 CONTRACT DETAILS .....	11

4.3	OVERALL THOROUGHNESS OF THE CONTRACT DOCUMENTS AND DRAWINGS .....	11
4.4	VULNERABILITY TO COST INCREASE .....	11
4.5	GENERAL CIVIL CONTRACT (GCC) .....	12
4.5.1	GCC Contract Document .....	12
4.5.2	Comparison of Bids.....	13
4.6	MAJOR EQUIPMENT .....	13
5	PROCUREMENT BONDING AND LIQUIDATED DAMAGE REQUIREMENTS .....	14
5.1	SCOPE OF WORK .....	14
5.2	BONDING AND LETTERS OF CREDIT .....	14
5.3	LIQUIDATED DAMAGES .....	16
6	QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS .....	17
6.1	SCOPE OF WORK .....	17
6.1.1	MH Quality Management .....	17
6.1.2	Turbine and Generator Contract #016321 .....	17
6.1.3	General Civil Works Contract #016203 .....	17
6.2	QUALITY CONTROL .....	17
6.3	QUALITY ASSURANCE .....	17
6.4	COSTS.....	18
7	OVERALL CIVIL CONTRACT PROJECT MANAGEMENT APPROACH .....	19
7.1	SCOPE OF WORK .....	19
7.2	CIVIL CONTRACT PROJECT MANAGEMENT APPROACH.....	19
7.3	PROJECT MANAGEMENT CONTROLS .....	19
8	PRE-TENDER CONSTRUCTION ESTIMATES AND ACTUAL TENDER PRICES .....	21
8.1	SCOPE OF WORK .....	21
8.2	GCC PRE-TENDER ESTIMATES AND ACTUAL TENDER PRICES.....	21
8.3	KEYASK LABOUR RESERVE CALCULATION.....	21
9	EXPECTED IN-SERVICE CAPITAL COST FOR KEYASK.....	23
9.1	SCOPE OF WORK .....	23
9.2	EXPECTED IN-SERVICE COST .....	23
10	CERTIFICATION.....	26

**TABLES**

Table 3.1 Probability (Risk Management) ..... 7

Table 3.2 Impact (Risk Management) ..... 7

Table 3.3 Risk Factor Matrix (Risk Management) ..... 7

Table 3.4 Risk Ranking (Risk Management) ..... 8

Table 3.5 Low, Reference, High ..... 10

Table 5.1 MH Procurement Bonding and Liquidated Damage Requirements ..... 15

Table 8.1 Labour Reserve ..... 22

Table 9.1 Contingency Comparison ..... 23

Table 9.2 Reserve Comparison ..... 24

Table 9.3 Capital Expenditure Forecast Break Down Summary ..... 25

**FIGURES**

Figure 7.1 Example of Project Dashboard ..... 20

**APPENDICES**

- Appendix A Terms of Reference for NFAT Supplemental Review
- Appendix B Material Used in Review



**ABBREVIATIONS**

AACE(I)	Association for the Advancement of Cost Engineering (International)
BNA	Burntwood Nelson Agreement
CCCT	Combined Cycle Combustion Turbine
CCGT	Combined Cycle Gas Turbine
CRC	Cost Reimbursable Contract
DB	Design Build
DBB	Design Bid Build
ECI	Early Contractor Involvement
EIS	Environmental Impact Statement
EPC	Engineering, Procurement and Construction
EPCM	Engineering, Procurement and Construction Management
FLCN	Fox Lake Cree Nation
GCC	General Civil Contract
GS	Generating Station
IDB	Integrated Design Build
IEC	Independent Expert Consultant
IFF	Integrated Financial Forecast
KCN	Keyask Cree Nation
KGSP	Keyask Generating Station Project
KHLP	Keyask Hydropower Limited Partnership
KIP	Keyask Infrastructure Project
NFAT	Needs For and Alternatives To
NGCD	Manitoba Hydro New Generation Construction Division
O&M	Operations and Maintenance
PDP	Proposed (or Preferred) Development Plan
PDS	Project Delivery Strategy
PEP	Project Execution Plan
PUB	Manitoba Public Utilities Board
RP	Recommended Practice (AACE International)
TCN	Tataskweyak Cree Nation
TCSM	Total Cost and Schedule Management
WLFN	War Lake First Nation
YFFN	York Factory First Nation

## 1 – INTRODUCTION

### 1.1 PURPOSE AND FORMAT OF REPORT

Through the intermediary of the Manitoba Public Utilities Board (PUB), the Government of Manitoba is carrying out a public Needs For and Alternatives To (NFAT) review and assessment of Manitoba Hydro's (MH's or Hydro's) Proposed Development Plan (Plan) for the Keeyask and Conawapa Generating Stations (GSs) and their associated transmission facilities. The PUB has engaged Knight Piésold Ltd. (KP) as an Independent Expert Consultant (IEC) to review the construction management and capital and operating costs for select resource options. KP has filed an IEC Report on their initial review of MH's proposals (KP Ref. VA103-449/1-1 Rev 1 of January 23, 2014). The PUB on January 10, 2014 asked KP to review additional information in relation to the report and Manitoba Hydro's intention to award the Keeyask General Civil Contract early in 2014 (see scope of work in Appendix A).

The following supplemental report summarizes KP findings on the additional scope of work. It does not include any further review of proposals for Conawapa. The content of this report is confidential and for the PUB only as it contains references to confidential material provided by MH.

### 1.2 APPROACH

#### 1.2.1 Reporting and Outline

Except for this Section 1, which highlights the report structure and particular aspects to bear in mind, the rest of the report is structured to address each of the PUB's questions to KP in turn, as per Appendix A.

#### 1.2.2 Source of Information (Manitoba Hydro)

The information reviewed for this supplemental report was obtained from MH, through a combination of teleconference presentations, email and hard copy transmittals - blue containing information deemed confidential by MH, and white for information not deemed confidential (that which is basically available as part of the public record).

A complete list of the material provided by MH and used in this review can be found in Appendix B.

#### 1.2.3 Limitations

As mentioned in KP's earlier report, the Capital Cost Estimate prepared by MH for the alternatives development was based on an initial "bottom up" approach in 2009 that considered construction productivity and schedules along with the cost of materials, equipment, and labour required for construction. This estimate was revised or "Stress Tested" in 2012, with major changes as a result of the experience gained at the recently completed MH Wuskwatim Project together with adjustments for escalation and some improvements in project definition. The focus of this supplemental report has been to examine in more detail MH's estimates and processes, ultimately in order to be able to comment on the likelihood that Keeyask will end up being constructed within the current MH budget estimate (of \$6.5 billion) but it should be cautioned that this examination has still been at a relatively high level, in accordance with the scope, budget and schedule available to KP, and that no guarantees can be given that the outcome will be as planned. With the award of the General Civil Contract (GCC) all parties have additional confidence in the eventual outcome than they did prior to this award, as this contract constitutes by far the largest element of the works.

## 2 – OVERALL MANAGEMENT STRATEGY AND SCHEDULING FOR TENDERING AND PROCUREMENT OF CONTRACTS

### 2.1 SCOPE OF WORK

*Question 1: “Review MH’s overall management strategy and scheduling for the tendering of contracts for the Keeyask Generating Station and the procurement of other major facility components such as spillways, dams, dykes, powerhouse, turbines, intake gates, generators, controls etc. Comment on the effectiveness of this management approach for minimizing capital costs, securing competitive bids, and managing construction and procurement cost escalation and construction risks.”*

### 2.2 MANAGEMENT STRATEGY FOR TENDERING

#### 2.2.1 Hydro’s Management Strategy

As mentioned in Section 4.3.2 of KP’s earlier IEC Report, the Keeyask Hydropower Limited Partnership (the Partnership) who owns the Keeyask Project has contracted all the planning, construction and operation of the project to MH. MH (through the New Generation Construction Division (NGCD) acts as the Project Manager and Construction Manager responsible for the overall project cost, schedule and quality. MH subcontracts a majority of the services and supplies required to actually build the project, and therefore manages and schedules the tendering and procurement.

MH’s systems are still maturing and MH has recently included an outsourcing some of the construction management as part of their estimate. As such the full management strategy is not truly finalized.

#### 2.2.2 Manitoba Hydro Documentation

As mentioned in Section 4.4 of KPs earlier report, the NGCD has a Project Execution Plan (PEP) for the development of the Keeyask Project. The draft document seen by KP acts as a high-level guideline to manage both the Keeyask Infrastructure Project (KIP) and the Keeyask Generating Station Project (KGSP).

The document:

- Is a guideline of the means, methods, tools and techniques used by MH to manage the KIP and the KGSP
- Serves as a record of the planning effort undertaken by the NGCD for the construction phase of the project, and
- Serves as a resource for staff to ensure the project is managed consistently.

The tendering and procurement of contracts is part of the overall procedures and processes described in the PEP and the associated documents. For the purpose of this report, KP was also provided with copies of the following NGCD policy and procedure documents to illustrate parts of the PEP:

- Total Cost and Schedule Management
- Engineering Consulting Contract Monitoring and Controls
- Construction Contract Monitoring and Controls
- Contract Change Management

- Risk Management
- Project Contingency Management, and
- Project Change Authorisation.

### 2.2.3 Total Cost and Schedule Management (TCSM)

In order to manage the scope of work to the approved budget and schedule MH has developed the TCSM procedure. The procedure outlines the approach to coordinating all the project service functions that support the monitoring and control the projects, using an iterative management approach called PDCA (Plan Do Check Act).

- The Plan stage involves establishing the project baseline schedule and budget.
- The Do stage involves implementing the project controls plan on awarded contracts and internal labour.
- The Check stage involves retrieving actual costs from the MH management system, SAP, and the latest schedule and forecasts from project leads.
- The Act stage involves assessing performance and managing change and contingency.

### 2.2.4 Overall Tendering and Procurement Management Strategy

The work required to complete the Keeyask Project has been divided into work packages. A MH Project Controls Coordinator is responsible for contract monitoring and controls process from the contract drafting to early periods of the contract execution. For each contract awarded the contract value is measured up against the base estimate and the relevant amount of contingency is allocated from the contingency pool (see Section 3). The PDCA iterative management approach ensures that the project estimate and schedule are updated accordingly.

A Work Package Lead (WPL) reviews the Contractor progress reports and ensures their timely weekly submission and communicates discrepancies/issues to the Contractor. A Cost and Schedule Section (CSS) is responsible for reviewing the updated contract schedules and updating the comprehensive schedules and checking against the contractor progress reports. The Project Accounting Section (PAS) tracks project-to-date cumulative actual dollars.

### 2.2.5 Contracts

MH intends to form separate contracts with the various contractors and has overall responsibility for interface management. MH's management strategy for tendering is a mixture of methods, tailored to the individual contracts. Thus the strategy for tendering the supply and installation of the turbine-generating equipment (TG Supply) is essentially fixed price whilst that for procuring the main civil works is essentially design-bid-build but with a target price and a process whereby the selected contractor is engaged early so that he might be involved in helping finalise contract details. KP deems this overall approach to be appropriate in principle. Section 4 of the previous KP report gives details of the various forms of contract used by MH.

### 2.2.6 GCC Early Contractor Involvement Process

The General Civil Contract (GCC) for the KGSP is to be executed using an Early Contractor Involvement (ECI) Process that has now begun. Having civil contractor involvement in the process two years before major construction begins offers the opportunity to:

- Ensure the contractors construction knowledge is incorporated into the design
- Refine the delivery schedule
- Secure the necessary labour; and
- Form alliances with Manitoba suppliers and sub-contractors.

### 2.3 SCHEDULING FOR TENDERING

The PEP states that project execution will follow the Hydro Cost and Schedule Standard (CSS) for schedule management. The overall schedule anticipates construction starting in July 2014 and being complete in January 2021. Procurement of long lead time items of equipment is already under way, in order to ensure delivery to site in time for incorporation in the works. Schedule performance is one of the key performance indicators tracked by MH.

Detailed and complete schedules for KGSP were included in both the 2009 Basis of Cost Estimate Report and the Request for Proposals (RFP) for the Keeyask GCC. The schedules and timelines are deemed to be appropriate and realistic, except for the Stage 1 Cofferdam which is deemed aggressive. They are consistent with the described developments and the anticipated work breakdown structures. It appears that MH has properly identified and appropriately scheduled items such as preparatory works (through the KIP) and long-lead-time items such as the supply of the turbine-generator equipment. It was not possible, however, to ascertain that adequate time has been built in to the schedule to cover MH's processes and procedures or any external owner requirements, such as reviews by Hydro or independent engineers.

The recent tenders submitted as part of this contract have validated the feasibility and reasonableness of the construction schedule. Validation Estimating has noted that the project team did find the GCC schedule to be very aggressive. See Section 7 for further discussion on this GCC.

MH has been unable to provide a comprehensive overall development schedule that includes design, procurement (all work required to prepare tender documents right to award) and construction (work after contract award to close-out). However, they believe they are presently generally on track with the projects; KP confirms this, based on the information received to date and the fact that the early development items are largely complete and the overall development schedule is now driven by construction and commissioning.

### 2.4 EFFECTIVENESS OF TENDERING AND PROCUREMENT MANAGEMENT APPROACH

#### 2.4.1 Minimizing Capital Costs

MH is using an appropriate approach towards minimising capital costs by sharing risk with the contractors and suppliers through the principal measures of advancing design prior to procurement, identifying and managing risks, and detailed management of the construction process.

#### 2.4.2 Securing Competitive Bids

The most significant contracts have been or are being procured through a competitive bid process (GCC and Equipment Supply). A number of projects have been procured through non-competitive DNCs because of a preference by MH for particular contractors to undertake specific work assignments. MH has drawn experience with this type of contract from the Wuskwatim project,

which had a number of DNCs. Since these contracts are not competitively bid, their value is closely related to the leverage held by MH and the diligence associated with the negotiation.

Internal MH costs may not be deemed competitive but KP does not have sufficient data to be able to offer an opinion on this issue.

#### 2.4.3 Managing Construction and Procurement Cost Escalation

It is difficult to measure MH's effectiveness in managing construction and procurement cost escalation as the current process is relatively new to MH and is significantly different from the old process. MH has a project controls coordinator who has constant access to such data as earned value charts, forecasts, trends and open issues that may affect the project and lead to unanticipated escalation. Opinions on MH's approach to the management of construction and procurement cost escalation are provided in the sections that follow.

#### 2.4.4 Managing Construction Risks

The project team and risk engineer execute the contingency management process, which includes the risk management process and the contingency management process. These are covered in Section 3.

#### 2.4.5 Procurement of other major facility components

To reduce scheduling risk and potential interface issues, a number of contracts were bundled with the GCC, including the Electrical and Mechanical Contract and excavation, cofferdams and draft tube forms. The reduction of interface risk was a lesson learned from the Wuskwatim project, which had several different contracts.

#### 2.4.6 Overall Assessment of Effectiveness

KP is able to see that MH is following a well-documented process despite the PEP presently being in draft form only. The project generally appears to be on schedule as it relates to Tendering and Procurement.

### 3 – CONSTRUCTION RISK MANAGEMENT STRATEGY

#### 3.1 SCOPE OF WORK

*Question 2: “Review Manitoba Hydro’s construction risk management strategy and comment on its effectiveness”*

#### 3.2 RISK MANAGEMENT STRATEGY

MH has a Risk Management Procedure (NGCD RSK-001 dated October 3, 2013) whose purpose is to “*detail the activities of planning, identifying, evaluating, responding, and monitoring for effective risk management as well as detailing the standard risk reporting templates...*” Related to this document are the Project Contingency Management Procedure (RSK-002 of November 10, 2013), and the Keeyask Project Risk Register. A Project Risk Report is also produced, showing contingency drawdown, schedule, one year look-ahead of project-specific risks based on project schedule, project risk profile, top 5 global and top 5 specific risks, and risk by phase of implementation. Confidential copies of all these documents were made available to KP.

Risks in the Risk Management Procedure are assessed on the basis of the product of Probability and Impact, broken down into the following categories:

- Technical (Requirements, Technology, Complexity and Interfaces, Performance and Reliability, Quality)
- Organisational (Project Dependencies, Resources (MH Staff), Funding, Prioritisation, Customer (Internal))
- Project Management (Estimating, Scheduling, Controlling, Communication)
- External (Regulatory, Market Intelligence, Performance and Reliability, Weather, Stakeholders), and
- Safety (Design Standards, Qualifications, Training and Awareness).

Tables 3.1 and 3.2 provide details for the assessment of Probability and Impact and Tables 3.3 and 3.4 the Risk Factor Matrix (where Probability and Impact are combined) and the Ranking system adopted. Although inevitably largely qualitative, quantitative ranges are given to guide the process. The process is deemed to very standard and appropriate overall for the KIP and KGSP.

**Table 3.1 Probability (Risk Management)**

Probability Rank	Description		Factor
	Threat	Opportunity	
Very Low (1)	Unlikely to Occur	Unlikely to Occur	<10%
Low (2)	May occasionally occur	Possible opportunity which has yet to be fully investigated.	10% to 30%
Medium (3)	Is as likely as not to occur	Opportunity may be achievable but will require careful management.	30% to 50%
High (4)	Is likely to occur	Clear opportunity which can be relied on with reasonable certainty	50% to 70%
Very High (5)	Is almost certain to occur	Is almost certain to occur	70% to 99%

**Table 3.2 Impact (Risk Management)**

Impact	Technical	Schedule	Cost
Very Low (1)	[REDACTED]	[REDACTED]	[REDACTED]
Low (2)	[REDACTED]	[REDACTED]	[REDACTED]
Medium (4)	[REDACTED]	[REDACTED]	[REDACTED]
High (8)	[REDACTED]	[REDACTED]	[REDACTED]
Very High (16)	[REDACTED]	[REDACTED]	[REDACTED]

**Table 3.3 Risk Factor Matrix (Risk Management)**

<b>Probability Factor</b>	>70% (5)	5	10	20	40	80
	50%-70% (4)	4	8	16	32	64
	30%-50% (3)	3	6	12	24	48
	10%-30% (2)	2	4	8	16	32
	<10% (1)	1	2	4	8	16
	Very Low (1)	Low (2)	Medium (4)	High (8)	Very High (16)	
	<b>Impact Factor</b>					



**Table 3.4 Risk Ranking (Risk Management)**

Combined Risk Factor Range	Risk Level	Response for NGC
1 to 4	Minor	Acceptable level of risk. Mitigation of risks is optional.
5 to 15	Moderate	Borderline level of acceptable risk. Must be mitigated to minor in stage 5.
>15 High	Critical	Unacceptable level of risk, must be mitigated to moderate in stage 4, or low in stage 5.

Risk categories in a MH presentation at a PUB Workshop in May 31, 2010 were somewhat different, viz:

- Market (Domestic and Export)
- Financial
- Environmental (including water supply and climate change)
- Infrastructure
- Human (including safety and union and employee issues)
- Business Operational
- Reputation
- Governance / Regulatory / Legal
- Aboriginal
- Emerging Technology, and
- Strategic.

At that time risks were summarised in a Risk Map, a matrix of Consequence and Likelihood.

Categories listed on the Risk Register also do not directly follow the above definitions but are more direct and detailed. Categories include:

- Auxiliary Processes and Services
- Concrete Structures
- Earth Structures
- Electrical and Mechanical Work
- Electrical Power Systems
- Environmental
- Excavation
- Geotechnical
- Global Construction
- Global Other
- Infrastructure
- Licensing
- Logistics
- Power Generation Systems
- Project Management
- River Management, and

- Stakeholder.

The major risks in the Risk Register (total risk score of 80, see Table 3.3) were perceived in August / September 2013 to be:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

MH proposes to deal with these risks by mitigation, through the Contingency and/or the Management Reserve.

### 3.3 EFFECTIVENESS

It is apparent that the new procedures and systems set up for Keeyask and Conawapa are a direct result of lessons learned on Wuskwatim and reflect a genuine concern on the part of MH to manage the whole process better. As far as can be seen, the risk management strategy is well set up and is being monitored and acted upon appropriately. Having chosen suitable, reputable and experienced contractors, construction risks are associated with contractor performance, in terms of quality, cost and schedule. MH carries some risk for known unknowns like quantities (which risk is mitigated by advanced design, investigations, good takeoffs and the GCC ECI process), and possibly to some degree schedule impacts of inclement weather. Portions of the contingency have been added to each contract, to cover unknown unknowns.

The whole issue ultimately comes down to cost. This is discussed further in Sections 8 and 9 of this report.

### 3.4 REVIEW OF THE RISK ANALYSIS AND CONTINGENCY ESTIMATE BY VALIDATION ESTIMATING

KP has reviewed the Keeyask Generation Station Project Capital Cost and Schedule Risk Analysis and Contingency Estimate report dated March 9, 2014 prepared for MH by John Hollmann of Validation Estimating LLC; the document describes the updated risk analysis and contingency estimate conducted for the Keeyask Generation Station Project (Project) using Validation Estimating LLC's contingency estimating methodology. KP has not had an opportunity to review other material prepared for MH by Validation Estimating that was included in the previous cost estimates.

Validation Estimating based the review on the updated estimate and schedule prepared by MH in November 2013. The costs were updated based on General Civil Contractor (GCC) bids received in December 2013 and continued assessment of cost and risk through February 8, 2014.

MH also provided KP with some of the associated tables by Validation Estimating that define the scope development and estimate maturity as the lead into the risk analysis. One aspect of the systemic risk analysis is that it is subjective. The interviews done to rate the level of scope development and other systemic risks in view of the analysis were performed with staff internal to MH, which may bias the perspective descriptions.

3.5 HIGH, LOW AND REFERENCE CASE

As per the March 27, 2014 Manitoba Undertaking #27 (MH Exhibit 104-8) the updated Capital Cost Estimates for Keeyask used in the Economic Uncertainty Analysis are as follows:

**Table 3.5 Low, Reference, High**

	<b>Keeyask 2019</b>		
	Low	Ref	High
Capital Cost	<b>3.0</b> B 2014 \$	<b>3.3</b> B 2014 \$	<b>3.7</b> B 2014 \$
Probability	20%	50%	30%
Capital Cost	<b>3.1</b> B 2014 \$	<b>3.6</b> B 2014 \$	<b>4.2</b> B 2014 \$
Probability	20%	60%	20%

These numbers are in agreement with the values determined by Validation Estimating.

#### 4 – REVIEW OF CONTRACT DOCUMENTS FOR MAJOR KEYASK COMPONENTS

##### 4.1 SCOPE OF WORK

*Question 3: “Review contract documents prepared by Manitoba Hydro for the major Keeyask components and comment on how such documents have been designed to secure cost effective bids from suppliers and contractors and where Manitoba Hydro may be vulnerable for cost increases, schedule changes etc. Comment on the overall thoroughness of the contract documents and drawings.”*

##### 4.2 CONTRACT DETAILS

The earlier KP report contains a description of the various forms of contract that are typically used for projects like the KGSP and the KIP. It is important to note that the work packages, including major Keeyask component supply, may not always correspond line for line to the Work Breakdown Structure (WBS) developed as part of the bottom-up estimate. As a result it is difficult for KP to reconcile dollars spent to date and anticipated future contract expenses for each specific element of the WBS.

Copies of various Keeyask contract documents were made available to KP as part of the original scope of work and commented upon in the earlier KP report. Details of the recently awarded GCC are discussed in Section 4.5 below.

##### 4.3 OVERALL THOROUGHNESS OF THE CONTRACT DOCUMENTS AND DRAWINGS

The contract documents and drawings that KP has seen have clearly been drawn up by competent, experienced engineers, from within MH and from reputable experienced consultants.

##### 4.4 VULNERABILITY TO COST INCREASE

As indicated in the earlier KP report, MH has stated that as of September, 2013, 29% of the 2012 \$3.05 billion Point Estimate had been covered by contracts that had already been awarded. It should be noted that award of contracts had not resulted in a change to the contingency allowance.

The earlier report essentially confirms that MH has made appropriate choices for the various Keeyask contracts – the contracts have been designed to secure the most cost effective bids from suppliers and contractors. All contracts except fixed price contracts (FPC) are somewhat vulnerable to cost increases but should still provide the most cost-effective solution by sharing risk and not insisting the contractor carry all the risk. If the contractor is made to carry all the risk he has to hedge his bets and build in to his price provision for the worst perceived possible outcome. If the worst case does not occur, the contractor pockets the unused provision as extra profit and nothing is returned to MH. Using non FPC contracts does, however, require MH to provide a contingency allowance for any unanticipated possible over-expenditure. Contingency provision is discussed in Sections 3 and 9.

Non FPC contracts have similar implications on schedule as they do on costs. It is necessary to specify the process by which schedule changes might be made if necessary. Any cost implications of schedule change should be included in the contingency.

Where possible increases can be anticipated and defined where they have been acknowledged and accounted for in a professional and competent manner that shares risks between MH and the service provider. KP has not been able to confirm that MH has an adequate level of project definition for the indirect costs (no detailed report describes these cost though KP has seen some high level detail.) in all areas and concludes that the indirects carry more risk of cost escalation than the direct works, which typically has a higher level of project definition.

#### 4.5 GENERAL CIVIL CONTRACT (GCC)

The General Civil Works Contract (GCC) represents the most significant single expenditure on the Keeyask Project. BBE Hydro Constructors Limited Partnership has been awarded a \$1.4 billion contract by Manitoba Hydro to construct the 695-MW Keeyask hydroelectric plant; the partnership includes Bechtel, Barnard Construction and EllisDon.

It is made up of a range of work packages including excavation, cofferdam construction, river management, dams, dykes, and electrical and mechanical works, as well as construction of the powerhouse and spillway structures. This contract was awarded in March 2014. MH has provided the following details of the contract document and the bids received.

##### 4.5.1 GCC Contract Document

The GCC has been structured on an Early Contractor Involvement (ECI) model to provide “the opportunity to collaboratively assess, mitigate and then appropriately allocate responsibility for risks in a manner that will align primary participant success with project success”. A two Phase process has been adopted in which Phase I is for the provision of ECI services (ECIS) and Phase II is for the actual construction of the civil and associated works.

The ECIS Phase I comprises:

- Task #1: An initial workshop between the three main entities – MH, the Engineer and the Contractor (on or about March 18, 2014)
- Task #2: Stage I cofferdam construction management plan (to be completed by June 1, 2014)
- Task #3: Contractor to develop concrete mix designs (by April 1, 2016)
- Task #4: Contractor input to design refinement and freeze point activities (by November 1, 2014)
- Task #5: Construction planning Contractor deliverables (by August 1, 2015)
- Task #6: Contract schedule for Phase II construction (before start of rock excavation in spillway)
- Task #7: Risk mitigation plan (by August 1, 2015)
- Task #8: Permit matrix (by August 1, 2015), and
- Task #9: Submittal Schedule (by August 1, 2015).

Phase II comprises the actual construction, on the following basis:

- An Initial Target Price submitted with the Bid based on the direct costs of extending and summing the products of quantities provided by MH and their Engineer and unit rates submitted by the Contractor (as per conventional design-bid-build contracts).
- Indirect costs reimbursed by the application of percentages bid by the Contractor for general administration and overheads (GA & O), and for profit, separate percentages being applied to the direct costs.

- Provisions for the adjustment of the Initial Target Price (to produce an Adjusted Target Price), chiefly due to escalation, and possible changes in the scope of work,
- The Contractor is encouraged at any time to make Value Engineering proposals (which, if accepted by MH, do not affect the Target Price)
- Any savings in cost (Actual Final Cost is less than Final Target Price) are attributed 80% to MH and 20% to the Contractor. Any cost overrun (Actual is more than Target) is attributed 80% to the Contractor (drawn from his Profit Percentage, to the limit of that amount) and 20% to MH. If the overrun exceeds 130% of the Final Target Price the Contractor will not receive his GA & O Percentage on any costs that exceed this amount.
- The Performance Security is in the form of Letters of Credit: [REDACTED]

4.5.2 Comparison of Bids

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

4.6 MAJOR EQUIPMENT

Approximately [REDACTED] of the total costs are for Major Equipment [REDACTED] i.e. turbine, generator, stop logs, transformers, switchgear, etc.

[REDACTED]

## 5 – PROCUREMENT BONDING AND LIQUIDATED DAMAGE REQUIREMENTS

### 5.1 SCOPE OF WORK

*Question 4: “Review construction and equipment procurement bonding and any liquidated damage requirements and comment on the appropriateness of such bonding and cost implications to the project.”*

### 5.2 BONDING AND LETTERS OF CREDIT

Performance bonding or letters of credit are normal contract requirements designed to protect an owner/developer against the contractor failing to perform. Bonding is typically used for civil construction work at the project site while letters of credit (LoC) tend to be used to procure mechanical and electrical equipment manufactured off site. MH have advised that the GCC however uses LoCs instead of bonding because it provides more security than a performance bond, given that the GCC is a cost reimbursable contract. The primary difference between the two is that a bond guarantees work will be performed, while a letter of credit promises that payments will be made.

A letter of credit promises to cover payments on an approved project, up to the stated credit amount. A bond puts up a specified amount of money to ensure contractual work will be performed to the contract standards. Both instruments provide a sum of money to enable the owner to repeat the procurement process if the contractor defaults. MH has made available to KP details of the bonding or letter of credit requirements for a selection of the major Keeyask contracts, in both the KIP and the KGSP. This information is summarised in Table 5.1. MH has indicated that the amounts are based on risks associated with the individual contracts, past experience, and industry norms.

It can be seen that where performance bonding has been required this has typically been in the amount of [REDACTED] of the value of the work whereas letters of credit have typically been for [REDACTED] of the value of the work. These values are deemed by KP to be appropriate. Performance bonds have sometimes in the past been as high as 100% but this adds a significant amount to the contract cost (the cost of the bonding is inevitably passed on to the owner, either expressly, as with the MH contracts, or elsewhere in the bid price), for an event which is not likely to materialise, certainly not in the full amount of the contract. Current practice is to strike a reasonable balance, protecting the interests of the owner while not paying an excessive premium for this insurance.

**Table 5.1 MH Procurement Bonding and Liquidated Damage Requirements**

Contract	Description	Bonding or Letter of Credit Details	Liquidated Damages
16102, 16103 and 16104	North Access Road B and A and Start Up Camp (DNCs)	[REDACTED]	
16120	Looking Back Creek Bridge (DNC)	[REDACTED]	[REDACTED]
16121, 16122, 16123, 16124 and 16125	Catering and Janitorial, Maintenance, Security, Employee Retention and Support, Emergency Medical Services (DNCs)	[REDACTED]	[REDACTED]
16127	Main Camp Facility - Phase 1	[REDACTED]	
16132	Work Site Area Development	[REDACTED]	
16150	PR 280 Upgrades - Spot Upgrade Improvements (DNC)	[REDACTED]	
16203	General Civil Contract	[REDACTED]	[REDACTED]
16321	Turbines and Generators	[REDACTED]	[REDACTED]
RFP 016305	Intake Gates, Guides and Hoists (same for Spillway Gates, Guides and Hoists)	[REDACTED]	[REDACTED]
	Powerhouse Crane	[REDACTED]	
	Main Electrical Contracts (Transformers, etc.)	[REDACTED]	



### 5.3 LIQUIDATED DAMAGES

Liquidated damages (LDs) are intended to protect the owner from the cost implications of having to live with substandard products and/or the cost impacts of late delivery. [REDACTED]

[REDACTED]

[REDACTED] LDs do not have to be proved and are payable by the contractor to the owner if triggered, regardless of actual cost, in the amount specified in the contract. There is normally a maximum limit to the total LDs that may be claimed. The alternative to LDs for compensation are penalties which suffer the disadvantage that they have to be proved e.g. the owner has to substantiate the costs or revenue loss he actually suffers in the event the turbine-generators produce less power than expected or the actual cost of a delay. Details of LDs for a selection of contracts are included in Table 5.1.

LDs are sometimes associated with a Performance Bonus (i.e. the upside of performing better than guaranteed, to counter the downside of performing worse). This is in principle a more equitable arrangement than one which only contains the downside. [REDACTED]

[REDACTED]

KP believes that the LDs stated in the various contracts made available appear to be reasonable and in keeping with their purpose.

## 6 – QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

### 6.1 SCOPE OF WORK

*Question 5: “Review Manitoba Hydro’s Quality Assurance and Quality Control (QA/QC) requirements for Keeyask construction and comment on the effectiveness and costs.”*

The most common arrangement for addressing quality in procuring hydroelectric power generating facilities is to make the Contractor responsible for Quality Control (QC) and the Owner (or his Engineer) responsible for Quality Assurance (QA). MH is conforming to this usual practice.

#### 6.1.1 MH Quality Management

Quality Management in MH is specified at a high level in the PEP with more detail being provided in a NGCD standard. Both documents define the processes required in MH to establish and operate a quality management program, including a third main activity that takes place prior to QC and QA, Quality Planning (QP).

MH made available to KP copies of the following documents to illustrate their approach to quality:

- Quality Management Section 5 of the Project Execution Plan (PEP)
- NGCD Standard #204 Quality Management (effective date 2012 07 17)
- QA/QC Requirements for the Turbine and Generator Contract 016321, and
- QA/QC Requirements for the General Civil Works Contract 016203.

#### 6.1.2 Turbine and Generator Contract #016321

With reference to this document, which has been awarded, it is noted in General Requirements Clause 48, Quality that:

- The Contractor’s own Quality Management System must “*conform fully to the spirit and intent of (the international quality management system) ISO 9001 2000*”.
- The Contractor is also obliged to have a Project Quality Plan and a Quality Team and various Inspection and Testing Plans (ITPs).
- The document is deemed to be detailed, comprehensive and appropriate for its purpose.

#### 6.1.3 General Civil Works Contract #016203

Clause 7.14 of the General Specifications for the GCC confirms that, for this contract, QC is the responsibility of the Contractor and QA the responsibility of the Engineer. Although details (provided in an appendix) were not made available to KP, KP is of the opinion that the details are likely to be appropriate.

### 6.2 QUALITY CONTROL

The requirements for QC are laid down in the contract documents and/or various standards (like the Canadian Standards Association CSA A23 for the production, inspection and testing of concrete).

### 6.3 QUALITY ASSURANCE

QA involves checking that the specified QC has been properly carried out: that the tests have been done, proper records have been kept, the records have been inspected and checked (in real time)

and that substandard results have been properly addressed. In the case of MH, QA will be performed by their site construction management team (including consultants).

#### 6.4 COSTS

The costs for the establishment and compliance monitoring of the MH quality requirements are not expressly shown. They form part of both the Contractor's and MH's site administration and management costs.

## 7 – OVERALL CIVIL CONTRACT PROJECT MANAGEMENT APPROACH

### 7.1 SCOPE OF WORK

*Question 6: "Review the overall civil contract(s) project management approach; comment on its effectiveness and what project management controls are in place to minimize cost escalations."*

### 7.2 CIVIL CONTRACT PROJECT MANAGEMENT APPROACH

The General Civil Contract (GCC) is being procured in an Early Contractor Involvement (ECI) process which provides an opportunity for MH and a selected contractor to work together to refine the contract. All aspects of the work, including design details, schedule, risk sharing and project management, are open for discussion. KP believes that this process reflects a genuine and appropriate opportunity for MH to optimise and bring as much certainty to the contract as possible.

For the last year and a half, all the KGSP contracts (including the GCC) have been and are being managed within the system-wide MH accounting system, SAP. The KIP is still largely being managed in the old MH system although efforts are being made by MH to get this project into the new system as well. The change in process makes it difficult to compare the 2012 estimates with the 2009 bottoms up estimates as they are formatted and arranged very differently particularly for the indirect costs.

The basis of the SAP system is "Network" Numbers, effectively WBS line items (or rows in the previous 2009 Excel spreadsheet based estimate). Network Numbers include all costs - directs and indirects (contract items, expenses, internal MH costs, consultants, etc.) whereas these costs were set out differently in the old Excel fields. MH has a big focus on schedule, as any extension of the schedule has inevitable financial consequences.

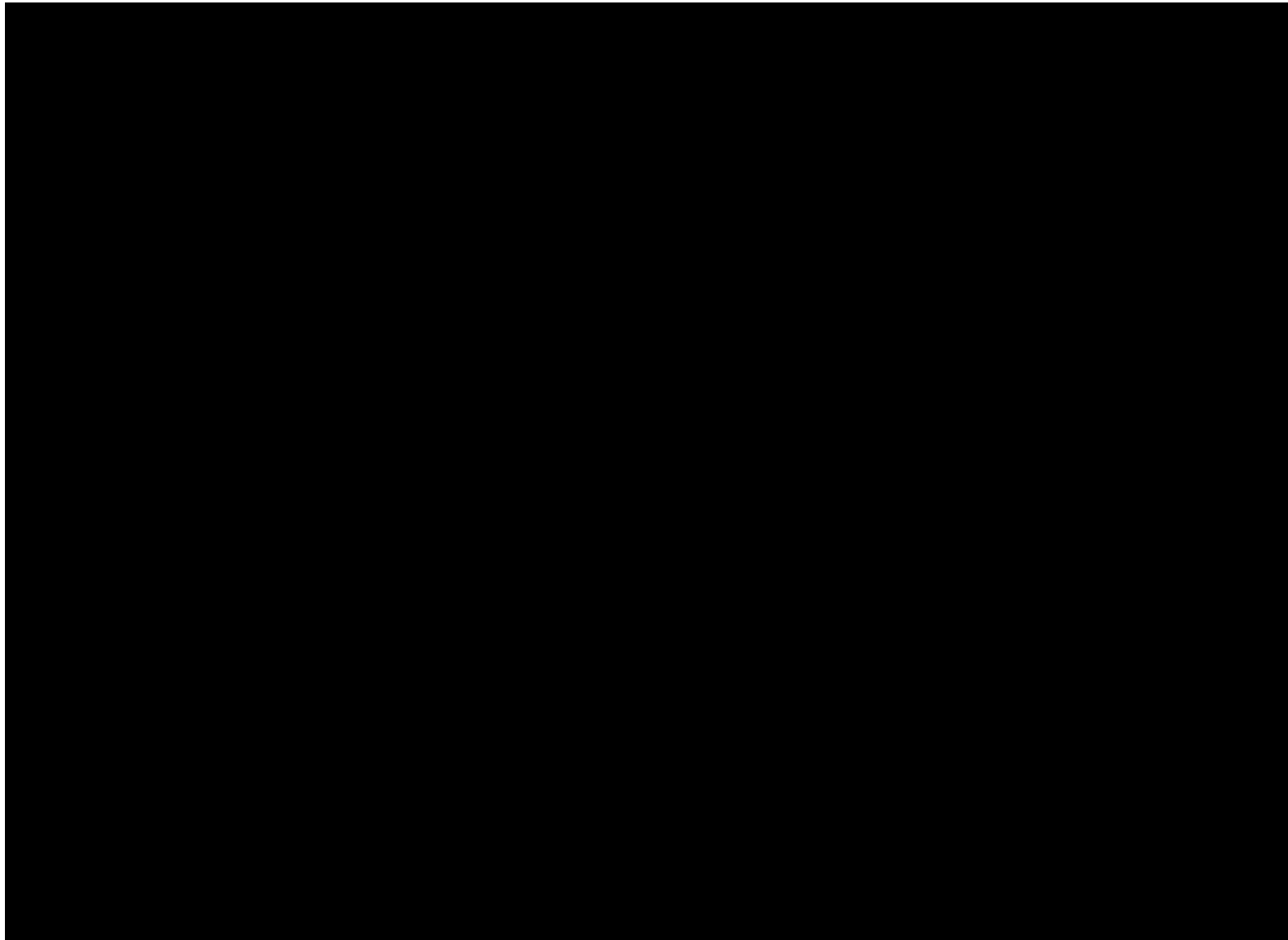
### 7.3 PROJECT MANAGEMENT CONTROLS

KP and MH held a conference call to discuss details of MH's management system. The following summary comes from that call and subsequent confidential material mailed to KP.

As contracts come in, or there are other reasons to revise estimates or allocations, "PCA"s (Project Change Authorizations) are used to transfer funds to and from the project contingency, in real time. There is a person in MH responsible only for managing the contingency. All significant Network #s have a portion of the overall contingency allocated to them, and have a contingency drawdown curve against which actuals and revisions to forecast are tracked. The project team only has access to the Contingency but not the Management Reserve.

MH keep a "CRR" (Contract Revision Register) that records budget changes like PCAs. They also have "Dashboards" which are effectively reports tailored to present information to particular audiences. An example of a dashboard report is included in the MH Risk Management Procedure (see Section 3). Another example is shown in Figure 7.1.

Estimates of future expenditure are adjusted in real time by adding inflation and deducting money spent to date. A check is also made at the same time on the expected final cost of each item i.e. that the budget is still appropriate. These changes are also recorded in other parts of the estimate, to keep the overall in-service cost the same. An overall reconciliation is done at the end of March every year, with quarterly reports in interim.



**Figure 7.1 Example of Project Dashboard**

**8 – PRE-TENDER CONSTRUCTION ESTIMATES AND ACTUAL TENDER PRICES**

**8.1 SCOPE OF WORK**

*Question 7: “Critically review Manitoba Hydro’s pre-tender construction estimates and compare with actual tender prices. Define where significant differences are noted and rationalize the specific differences.”*

**8.2 GCC PRE-TENDER ESTIMATES AND ACTUAL TENDER PRICES**

MH has provided KP with summary presentation material and Bills of Quantities comparing the GCC proposals, the independent estimators estimate (by Chant), and an escalated original Engineers Estimate by KGS Acres. KP believes that Hydro has been diligent in their internal comparison between the four GCC tenders, their Engineers estimate and the independent Third Party Estimate.

[REDACTED]

Generally quantities have been confirmed by the bidding contractors and the independent third party estimator. [REDACTED]

[REDACTED]

[REDACTED]

**8.3 KEEYASK LABOUR RESERVE CALCULATION**

[REDACTED]



**9 – EXPECTED IN-SERVICE CAPITAL COST FOR KEYASK**

9.1 SCOPE OF WORK

Question 8: “Provide an opinion as to the expected in-service capital cost for Keeyask once all work has been completed.”

9.2 EXPECTED IN-SERVICE COST

MH has indicated in the recent hearings, that based on the results of the GCC bids and the award of that contract that their estimated total in-service cost is now \$6.5 billion (was \$6.2 billion). Validation Estimating states that “the recent incorporation of GCC contract costs reduced the uncertainty in respect to competitiveness of the estimate.” The reassessment included a reappraisal of their contingency (updating their contingency model) and management reserves; KP has no better data to offer a better estimate of the expected in-service capital cost for Keeyask and therefore generally concurs with the estimate with the following reservations:

- KP believes that there remains systemic risks to the project that cannot be easily mitigated. While the direct scope is well-defined the project implementation plan is still in progress and Hydro’s management systems are not yet mature, these combined risks lower the level of project definition and could lead to increases in project risks and associated costs. As stated by Validation Estimating cumulatively the schedule risks threaten to drive the project into an additional year of construction and the seasonal nature of the work results in a greater schedule risk than a typical mega-project. [REDACTED]
- When determining the Management Reserve and Contingency, a more conservative approach would be to adopt a higher escalation reserve (closer to 3.1%) [REDACTED] A higher contingency based on the P80, as compared to Hydro’s use of a P50, would also be recommended for the conservative estimate.
- The Tables 9.1 and 9.2 below compare Hydro’s Contingency and Management Reserve amounts to those recommended for a Conservative View.

**Table 9.1 Contingency Comparison**

	Hydro	Conservative View
	P50	P80
Contingency	327 M\$	691 M\$



**Table 9.2 Reserve Comparison**

	Hydro	Conservative View
One Year Delay due to Stage One Cofferdam Delay	[REDACTED]	[REDACTED]
Labour Reserve Case	[REDACTED]	[REDACTED]
Escalation	[REDACTED]	[REDACTED]
<b>Total Reserve</b>	[REDACTED]	[REDACTED]

While Hydro's Reference Cost is appropriate, a more conservative view might be warranted when considering and making allowances for the Total Project Contingency and Management Reserve.

TABLE 9.3

MANITOBA PUBLIC UTILITIES BOARD  
NFAT REVIEW OF KEYASK AND CONAWAPA GS

CAPITAL EXPENDITURE FORECAST BREAK DOWN SUMMARY

07/04/2014 13:20

	Keyask GS					March 10, 2014 Update	KP Review
	2009 Estimate	CEF2010	CEF2011	CEF2012	CEF2013		
<b>BASE COST</b>							
<b>POINT ESTIMATE</b>							
<b>KEYASK GENERATING STATION COST ESTIMATE</b>							
<b>DIRECTS</b>							
<b>Overnight Direct Cost of Generating Station</b>							
River Management							
Earthfill Dams and Dykes							
Spillway and Transition Structures							
Powerhouse Complex							
Miscellaneous Directs							
Addition to Reflect GCC Tender							
<b>Total Estimated G.S. Direct Costs (without Contingency)</b>							✓
<b>Outlet Transmission Project (without Contingency)</b>							✓
<b>INDIRECTS</b>							
Studies and Investigations							✓
Environmental & Mitigation							?
Construction Power							✓
Infrastructure							?
K.I.P. (Base Estimate)							?
Service Contracts Planning / Environmental / Construction							?
MH Office and Labour							
Expenses & External Groups							X
Labour and Material Provisions							?
Labour & Expenses							✓
<b>Total Estimated Indirect Costs</b>	1,071	1,141		1,323		1,298	?
<b>Total G.S. Point Estimate</b>	2,705	2,806		3,049	3,060	3,357	
<b>Total Transmission Base Estimate</b>	93	105		137	137	138	
<b>Total "Point Estimate"</b>	2,798	2,911		3,186	3,197	3,495	✓
<b>UNCERTAINTY</b>							
<b>P50 Based Contingency</b>	507	516		547	540	327	X
<b>Management Reserve</b>							
<b>Labour Reserve</b>				384	384	304	X
<b>Escalation Reserve</b>				118	116	88	X
<b>Total Management Reserve</b>				500	500	392	
<b>TOTAL BASE COST</b>	3,305	3,427	3,395	4,233	4,237	4,214	
<b>INTEREST AND ESCALATION</b>							
<b>Escalation at Consumer Price Index Level</b>		498		416	330	311	✓
<b>Capitalized Interest</b>				873	1010	900	✓
<b>Interest on Manitoba Hydro Equity</b>	1347			198	200	218	✓
<b>Total Project Interest and Escalation</b>	1,845	1,820		1,485	1,540	1,429	✓
<b>MONEY SPENT TO DATE</b>							
Studies & Investigations							
Environmental & Mitigation							
Transmission							
Construction Power							
MH Office and Labour							
Expenses & External Groups							
KIP (excluding MH Labour)							
Infrastructure							
River Management (Test Ice Boom)							
Turbines & Generators							
<b>Total Actuals</b>	285	296	356	450	450	627	✓
Interest on Capital	100	126	156			225	✓
<b>Total Money Spent to Date</b>	385	422	512	450	450	852	✓
<b>INSERVICE COST</b>							
<b>In-service Cost</b>		5,837	5,837	6,230	6,227	6,495	✓
<b>Check Total Project Cost (from CEF Documents)</b>		5,837	5,837	6,220	6,220	6,495	

M:\1103\00449\01\A\Report\2 - Knight Piesold Supplemental Review Report\Rev D\Tables\Table 9.1 Keyask Cost (SRM).xlsx\Keyask

Legend

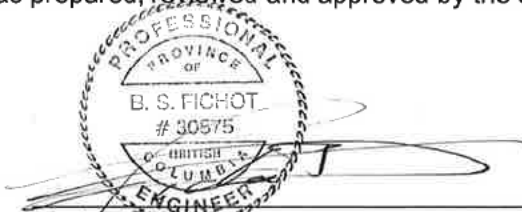
- 25 Indicates a number that KP can calculate from others.
- 137 Indicates a number provided by Hydro.
- Information shared with KP but not disclosed to PUB.

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
1	07APR11	ISSUED WITH REPORT VA103- 01-2	BP	MJR	SRM
2	18SEP11	ISSUED WITH REPORT VA103- 01-3	BP	MJR	SRM

**10 – CERTIFICATION**

This report was prepared, reviewed and approved by the undersigned.

Prepared:



Boris Fichot, P.Eng.  
Senior Engineer

Reviewed:

*J.S.M.*  
for.

Mike Robertson, P.Eng.  
Specialist Engineer

Approved:



Sam Mottram, P.Eng.  
Managing Principal – Power Services

This report was prepared by Knight Piésold Ltd. for the account of Manitoba Public Utilities Board. Report content reflects Knight Piésold's best judgement based on the information available at the time of preparation. Any use a third party makes of this report, or any reliance on or decisions made based on it is the responsibility of such third parties. Knight Piésold Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This numbered report is a controlled document. Any reproductions of this report are uncontrolled and might not be the most recent revision.

April 2014 Redacted

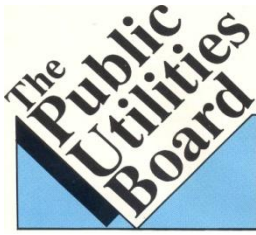
MANITOBA PUBLIC UTILITIES BOARD  
NFAT REVIEW OF KEEYASK AND CONAWAPA GS

***Knight Piésold***  
CONSULTING

**APPENDIX A**

**TERMS OF REFERENCE FOR NFAT SUPPLEMENTAL REVIEW**

(Pages A-1 to A-3)



The Public Utilities Board  
400 – 330 Portage Avenue  
Winnipeg, Manitoba, Canada R3C 0C4  
T 204-945-2638 / 1-866-854-3698  
F 204-945-2643  
Email : [publicutilities@gov.mb.ca](mailto:publicutilities@gov.mb.ca)  
Website : [www.pub.gov.mb.ca](http://www.pub.gov.mb.ca)



Régie des services publics  
330, avenue Portage, pièce 400  
Winnipeg (Manitoba) Canada R3C 0C4  
Tél. 204-945-2638 / 1-866-854-3698  
Télé. 204-945-2643  
Courriel : [publicutilities@gov.mb.ca](mailto:publicutilities@gov.mb.ca)  
Site Web : [www.pub.gov.mb.ca](http://www.pub.gov.mb.ca)

January 13, 2014

Law Department  
Manitoba Hydro  
22 - 360 Portage Avenue  
Winnipeg MB R3C 0G8

**Attention: Patti J. Ramage / Marla J. Boyd**

Dear Ms. Ramage and Ms. Boyd:

**Re: Keeyask Tenders - Approved Scope of Work for Knight Piésold**

The Public Utilities Board ('Board') is informing you that the attached Scope of Work has been approved by the Panel to be completed by Knight Piésold. As such Manitoba Hydro is asked to:

1. Place all related Contracts and Tender Documents that pertain to the Keeyask project in the CSI Rooms; and
2. Provide copies of the Keeyask Contracts and Tender Documents to Knight Piésold via the IEC SharePoint site.

The Board is requesting that the requested information be made available as soon as possible, considering that the report requested by Knight Piésold be submitted by February 4<sup>th</sup>, 2014.

Sincerely,

H.M. Singh  
Secretary

cc: Bob Peters/Sven Hombach - Board Counsel  
Christian Monnin/Michael Weinstein - IEC Legal Counsel  
All Parties

## Knight Piesold - Proposed Revised Scope of Work

*As approved by the NFAT Panel on January 10, 2014.*

Manitoba Hydro has indicated in their correspondence of December 4, 13, and 30th of Manitoba Hydro's intention to award the Keeyask General Civil Contract early in 2014. Manitoba Hydro intends to seek Manitoba Hydro Board approval of the contract in February of 2014. It is the opinion of the Public Utilities Board that the review of tendered costs for Keeyask is of significant importance for the understanding of the projected capital costs.

The overall objective of the revised scope of work for Knight Piésold (KP) would be to validate Manitoba Hydro's overall cost estimate and tendering practices for Keeyask and the accuracy of Manitoba Hydro's cost estimating approach.

The proposed scope of work for KP to complete this objective is provided below.

- Review MH's overall management strategy and scheduling for the tendering of contracts for the Keeyask Generating Station and the procurement of other major facility components such as spillways, dams, dykes, powerhouse, turbines, intake gates, generators, controls etc. Comment on the effectiveness of this management approach for minimizing capital costs, securing competitive bids, and managing construction and procurement cost escalation and construction risks.
- Review Manitoba Hydro's construction risk management strategy and comment on its effectiveness.
- Review contract documents prepared by Manitoba Hydro for the major Keeyask components and comment on how such documents have been designed to secure cost effective bids from suppliers and contractors and where Manitoba Hydro may be for vulnerable for cost increases, schedule changes etc. Comment on the overall thoroughness of the contract documents and drawings.
- Review construction and equipment procurement bonding and any liquidated damage requirements and comment on the appropriateness of such bonding and cost implications to the project.
- Review Manitoba Hydro's Quality Assurance and Quality Control (QA/QC) requirements for Keeyask construction and comment on the effectiveness and costs.
- Review the overall civil contract(s) project management approach; comment on its effectiveness and what project management controls are in place to minimize cost escalations.

- Critically review Manitoba Hydro's pre-tender construction estimates and compare with actual tender prices. Define where significant differences are noted and rationalize the specific differences.
- Provide an opinion as to the expected in-service capital cost for Keeyask once all work has been completed.
- Provide a supplemental report to the Panel incorporating this work by February 4th, 2014.

April 2014 Redacted

MANITOBA PUBLIC UTILITIES BOARD  
NFAT REVIEW OF KEEYASK AND CONAWAPA GS

***Knight Piésold***  
CONSULTING

**APPENDIX B**

**MATERIAL USED IN REVIEW**

(Page B-1)



# April 2014 Redacted

## Appendix B: Material Used in Supplemental Review Report (NFAT - IEC Knight Piésold Ltd.)

M:\1103\00449\01\A\Report2 - Knight Piesold Supplemental Review Report\Rev 0\App B - List of Material Used in Review.xlsx>List

Document Index	Document Title
----------------	----------------

### Additional Information Provided by Manitoba Hydro

Phone Call April 7, 2014	Reserve Calculation
Email Dated April 2, 2014 and Letter April 2, 2014	Capital Expenditure Forecast Break Down Summary - Updated with CEF 2013 and March 10, 2014 revisions.
Email Dated March 27, 2014	243953-0125-EST-KGS Estimate Cost Breakdown for the New WBS 2014-2014031 Keeyask and Conawapa Labour Reserve Calculation Keeyask Generating Station - Monthly Project Dashboard Report - As at Feb 28, 2014
MH Exhibit #109 - Transcript Page #1816 MH Exhibit #113 - Transcript Page #1820 MH Exhibit #137 - Transcript Page #3806	Manitoba Hydro Undertaking #34 (March 13,2014) Manitoba Hydro Undertaking #35 (March 19,2014) Manitoba Hydro Undertaking #62 (March 27,2014)
Letter March 12, 2014 ("blue paper")	1. Copy of presentation made in conference call March 5 on the Keeyask and Conawapa Estimate Update <ol style="list-style-type: none"> <li>a. Table Updated: NFAT Results Keeyask               <ol style="list-style-type: none"> <li>i. Base Costs Comparison Added</li> <li>ii. Total In Service Costs 2012 Values Updated</li> </ol> </li> <li>b. Table Updated: NFAT Results Conawapa               <ol style="list-style-type: none"> <li>i. Base Costs Comparison Added</li> <li>ii. Total In Service Costs 2012 Values Updated</li> </ol> </li> <li>c. Table Updated: Conawapa 2026 NFAT Detailed View               <ol style="list-style-type: none"> <li>i. NFAT Submission Chapter 11, Low and High, Escalation and Capitalized Interest Updated.</li> </ol> </li> </ol> 2. Keeyask Estimate Summary Sheet <ol style="list-style-type: none"> <li>a. Table Updated: Interest and Escalation Updated</li> </ol> 3. Keeyask Contingency (Risk Consultant) Report and Appendices (Systemic Risk, Risk Tool, Labour Shortage)
Conference Call March 5, 2014	
Letter February 28, 2014 ("blue paper")	KIP Estimate Summary Sheet and Details Labour Reserve Calculations Copy of presentation made in conference call February 27 Keeyask GCC Workforce Proposals Graph, Bidder Contingency Summary, Engineer's Estimate and Proponent's Bid Comparison Summary
Conference Call February 27, 2014	
Emails February 16, 2014	Responses by [REDACTED] (NGCD) to questions on Bonding and LDs Responses by [REDACTED] (NGCD) to questions on Risk and Schedule
Letter February 7, 2014 ("blue paper")	Information on contract surety for KIP and KGSP
Conference Call February 6, 2014	
Email January 30, 2014 ("white paper")	QA/QC Requirements from Turbine/Generator Contract Specification (Clause 48) Standard #204 Quality Management - Execution, Detailed Design, Program. Dated 2012-07-17 Excerpt from PEP Section 5 Quality Management
Letter January 30, 2014 ("blue paper")	Response to KP/MH II-027 as filed with the PUB
	MH New Generation Construction policies and procedures: PSD-002 Total Cost and Schedule Management. Dated 2012-06-29
	PCC-001 Engineering Consulting Contract Monitoring and Controls. Dated 2013-08-26 PCC-002 Construction Contract Monitoring and Controls. Dated 2013-08-26 PAS-001 Contract Change Management. Dated 2013-10-22 RSK-002 Project Contingency Management. Dated 2013-10-29 Standard #801 Project Change Authorisation. Dated 2013-10-16
Letter January 27, 2014 ("blue paper")	Copy of Presentation on Capital Cost Estimates for Keeyask and Conawapa Generating Stations from Conference Call January 23, 2014
	Keeyask GS Cost Estimate (2009), Estimate Summary and Indirects Summary Sheets
	[REDACTED] - Cost and Schedule Section Lead [REDACTED] - Project Services Manager [REDACTED] - Cost and Schedule Engineer [REDACTED] - Project Accounting Lead [REDACTED] - Project Controls Lead [REDACTED] - Cost and Schedule Officer
Conference Call January 23, 2014	
Letter January 16, 2014 ("blue paper")	Response to KP/MH II-027 with more detail than PUB version January 30
Conference Call January 16, 2014	
Letter September 12, 2013	Request for Proposal 016203 - General Civil Works

### Other

KP Main Report , VA103-449/1-1 Rev 1 January 23, 2014 Knight Piésold Independent Expert Consultant Report (Confidential)