ADDENDUM TO

Kelsey Generator Re-Runnering

Interconnection Facilities Study

Performed by:

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Executive Summary

An Interconnection Facility Study (IFS) has been performed to determine the Transmission Owner Interconnection Facilities, Interconnection System Upgrades and Network Upgrades necessary to interconnect an additional 77 MW at the existing Kelsey G.S. (Township 81, Range 6 EPM) on the Nelson River near the town of Thompson, Manitoba. The IFS is based on the assumption that the proposed generation will be designated as a Manitoba Hydro (MH) Network Resource under the Open Access Transmission Tariff (OATT) by the Transmission Customer requesting Transmission Service. As a Network Resource, the impacts of scheduling to MH generation and Network Load were evaluated. MH's Network Load is located entirely within the Province of Manitoba. Therefore, the new generation will not require the need to increase transfer levels on the Manitoba to Ontario, Saskatchewan or U.S. boundaries. The Transmission Owner Interconnection Facilities and Interconnection System Upgrades are determined for a maximum plant size of 350 MVA.

Although this IFS Report contains transmission study results, based on directions from the Interconnection Customer that MH make certain assumptions for the purposes of this IFS regarding the type of transmission service that will be reserved by the Interconnection Customer, the Interconnection Customer is nevertheless obligated to reserve Transmission Service through the appropriate procedures under the MH OATT.

The IFS determined the impact that the additional generation has on the existing MH transmission system by means of steady-state post disturbance analysis (VSAT), constrained interface analysis, stability analysis (TSAT), and short circuit analysis. This was completed for a comprehensive range of conditions including prior outages and breaker fail (stuck breaker) scenarios as stated below;

1. N-1 contingency analysis for all transmission lines and transformers 110 kV and above within Manitoba including tielines.
2. N-2 contingency analysis for all 110 kV and above common-tower and breaker fail outages approximately two buses back from Kelsey.
3. N-1 contingency analysis for critical prior outages in Manitoba.

There are no short circuit concerns for existing equipment following the addition of the new Kelsey generation.

Voltage flicker and voltage quality are not a concern.

Several thermal overloads and stability issues are identified that require continuing use of generator cross-tripping at Kelsey and Grand Rapids. The new Northern cross-trip scheme at Kelsey that will be in-service by 2006 will accommodate the additional Kelsey output, but may require minimal internal logic changes to the controller depending on whether or not Wuskwatim is in-service.

In order for the generator to obtain Energy Resource Interconnection Service and connect the additional output of the plant to the system and be eligible to deliver this output as

firm or non-firm capacity, Interconnection System Upgrades (ISU) are required in the Kelsey 138 and 230 kV stations. Riser replacement and bus reconductoring is required at Kelsey station. The estimated cost of these facilities not including interest or escalation is **$621,015**.

Additional costs, not including interest or escalation, attributed to Kelsey were uncovered in the recent Wuskwatim 23 MW addition IFS and from new information obtained from Power Supply's - Electrical Engineering group;

Interconnection System Upgrades for ERIS = 315 MW

1.) Northern AC Cross-trip scheme revisions, these will consist of internal software logic changes to the controller at Kelsey. Planning specification study and detailed Operating study required. The estimated cost of these facilities is **$157,000**.
2.) Incorporate a breaker fail scheme to include the Kelsey 138 kV bus using the new protection on the generating units. The estimated cost of these facilities is **$1,1,570,000**.
3.) Installation of a Phasor Measurement Unit (PMU) in the Kelsey area. The estimated cost of these facilities is **$140,400**.

Network Upgrades for NRIS = 251 MW

1. Add 230 kV circuit switchers to the existing line reactors on lines G8P and G9F at Grand Rapids switching station. The estimated cost of these facilities is **$773,423**.
2. The existing Grand Rapids Unit 3 cross-trip scheme needs to be made redundant in order to be considered a Special Protection System (SPS) and comply with NERC standards. The estimated cost to upgrade this cross-trip scheme is **$785,000**.

Total cost to the Generator for these upgrades including the original ISU cost is **$4,046,838 these new costs are based on class 1 (planning) estimates and do not include interest or escalation. Class 2 estimates are in the process of being completed, this document will be updated as soon as they become available.**

Limitations of operation (as per the OATT) of Kelsey may be required to mitigate potential overloads for several prior outages. The most critical prior outages include: A3R, A4D, G8P, P18H, H59C, P19W, K24W, KT1, KT2 and MLR Bank 8 or 9. Depending on the amount of load and generation connected at the time of the outage, Kelsey operation may be limited by between 30 and 200 MW.

The addition of the Kelsey generation does not impact MAPP or MISO flowgates and does not impact MH-US transfer capability.

Network Upgrades for NRIS = 315 MW

In order for the generator to obtain Network Resource Interconnection Service (NRIS) for the full output of the facility, Network Upgrades are required pre and post Wuskwatim. A 130-km 230-kV transmission line is required between Dauphin and Neepawa to alleviate thermal overloading and voltage collapse issues post Wuskwatim. The new line will also reduce system losses and allow for more of Kelsey's total capacity to be exported and/or serve Manitoba load. The line is estimated to cost $38.3 million. Without this new line, the existing network can accommodate NRIS service for approximately 15 MW of the 77 MW total at Kelsey.

The Generator has elected to construct the necessary upgrades to obtain Network Resource Interconnection Service for 251 MW. The remaining 64 MW will be connected as Energy Resource Interconnection Service.

9.0 Identification of Transmission Owner Interconnection Facilities, Interconnection System Upgrades and Cost Estimates

9.1 Required Facilities

The transmission facilities required to interconnect the additional Kelsey Generation to the Manitoba Hydro transmission system are comprised of the following:

Post-Wuskwatim

Interconnection System Upgrades	ERIS = 315 MW
Kelsey 138 kV and 230 kV Bus & CT Changes. Includes re-conductoring a portion of the Kelsey 138 kV ring bus and the 230 kV line R26K and K24W terminations and changing CT ratios for breakers R2 and R3)	$621,014.50
Incorporate a breaker fail scheme to include the Kelsey 138 kV bus using the new protection on the generating units.	$1,570,000.00*
Northern AC Cross-trip scheme revisions. These will consist of internal software logic changes to the controller at Kelsey. Planning specification study and detailed Operating study required	$157,000.00*
Installation of a Phasor Measurement Unit (PMU) in the Kelsey area	$140,400.00*
Network Upgrades	NRIS = 251 MW
Add 230 kV circuit switchers to the existing line reactors on lines G8P and G9F at Grand Rapids switching station	$773,423.00*
Grand Rapids Unit 3 Cross-Trip scheme Upgrade to SPS. These will consist of upgrading the existing scheme to be NERC compliant with a SPS.	$785,000.00*
Total	$4,046,837.50
Network Upgrades	NRIS = 315 MW
Dauphin Vermilion – Terminate Neepawa 230 kV Line	$2,490,000
New Neepawa 230 kV Station Includes development of new station site and termination of 3 – 230 kV lines (Neepawa-Dauphin, Neepawa-Cornwallis & Neepawa-Dorsey)	$10,331,800
Dauphin Vermilion to Neepawa 230 kV Transmission Line Includes Gulport structures located on easement adjacent to public road allowances, OPGW as one of the two ground conductors and extensive site selection and environmental assessment activities	$25,163,150
Neepawa Station New 230 kV Termination Includes construction of 800m of 230 kV double circuit transmission line into Neepawa station utilizing OPGW as the ground conductor	$431,500
Total	$38,416,450

Costs do not reflect interest or escalation.
*Note: costs in red font are class 1 estimates only, class 2 estimates are in the process of being completed by Station Design.

The new Dauphin to Neepawa 230 kV line (Network upgrade) is required only if the full 77 MW Kelsey addition involves Network Resource Interconnection Service.

Sections 9.3 through 9.6 discuss the scope of work and facilities in more detail as determined in class 2 estimates. A detailed construction schedule is attached at the end. The in-service dates assume that the Interconnection and Operating agreement is executed by the end of July 2006 and that environmental licensing process starts on August 1, 2006. The Cost allocation for the Network Upgrades will be determined when the Transmission Customer applies for Transmission Service.

9.2 Cost Estimate

A cost estimate has been determined for the above facilities. Table 22, 23, 24 and 25 below provides a summary of the current gross costs excluding interest or escalation.

Class 2 estimates (+/-30% error) have been produced for all station and line components.

Table 22 - Kelsey G.S. 138 kV Ring Bus and 230 kV Switchyard Bus Upgrade Cost Estimate.

Department	Cost
Protection Design	*
Protection Control and Metering	*
Kelsey G.S. Electrical & Operating	*
Civil Steel Design	*
Structure, Equipment & Grounding	*
Live Line Tools	*
Electrical construction field	*
Interlake North Construction	*
System Support (Protection)	*
Commissioning	*
Contingency	$56,300
Project Total includes contingency & OH.	$621,015

*Re-estimated in early 2007, cost breakdown currently unavailable.

Table 23 - New Neepawa 230 kV Station Cost Estimate

Department	Cost
Apparatus	$1,601,419
- 230kV breakers (3)	
- 230kV CT's (9)	
- 230kV CVT's (12)	
- 230kV disconnects (9)	
Communications	$892,750
Protection Design	$116,299
Protection Control and Metering	$1,134,007
SCADA	$178,238
Civil Design	$785,506
Civil Construction	$1,605,716
Electrical construction field	$970,403
System Performance	$11,065
Line Construction	$682,794
TSS-Aux Equipment Group	$63,877

Apparatus Mtce.	$224,940
Project Coordination	$89,619
System Support/Recorder	$5,464
System Support/Relay and Metering	$106,888
Insulation Testing	$9,960
Structure, Equipment & Grounding	$455,553
Contract	$1,528,132
Commissioning	$139,150
Contingency	$706,823
Project Total includes contingency & OH.	**$10,331,782**

Table 24 - Dauphin - Vermilion 230 kV Station Cost Estimate

Department	Cost
Apparatus	$506,000
- 230kV breakers (1)	
- 230kV CT's (3)	
- 230kV CVT's (4)	
- 230kV disconnects (3)	
Communications	$568,602
Protection Design	$51,674
Protection Control and Metering	$252,680
SCADA	$29,679
Civil Design	$92,446
Civil Construction	$194,594
Electrical construction field	$283,284
Apparatus Mtce.	$37,854
Project Coordination	$45,151
System Support/Relay and Metering	$15,365
Structure, Equipment & Grounding	$169,212
Commissioning	$68,570
Contingency	$152,328
Project Total includes contingency & OH.	**$2,489,969**

Table 25 Birchtree SVC and 230 kV station Cost Estimate

Department	Cost
Apparatus	$1,741,829
- 230kV breakers (3)	
- 230kV CT's (12)	
- 230kV CVT's (9)	
- 230kV disconnects (12)	
Communications	$595,000
Protection Design	$287,719
Protection Control and Metering	$965,004
SCADA	$323,241
Civil Design	$844,514
Civil Construction	$4,890,647
Electrical construction field	$1,801,259
Apparatus Mtce.	$142,403
Project Coordination	$211,593

Structure, Equipment & Grounding	$596,982
Commissioning	$563,414
Contingency	$400,000
SVC	$19,534,000
Project Total includes contingency & OH.	**$32,897,605**

9.3 Kelsey 138 kV Ring and 230 kV switchyard Station Bus Upgrade Scope of Work

The work at Kelsey station includes the following;

- Re-conductor the existing 138 kV ring bus and 230 kV switchyard bus to provide a summer ampacity of 1200 Amps.
- Install 500 mcm copper conductors in parallel with existing 500 mcm conductors with new strain relief insulators.
- Install single 1272 ACSR in the 230 kV switchyard with double 795 ACSR for the risers on both R26K and K24W bays.
- Change 52-3F and 52-2F current transformer ratio from 800/5 to 1200/5. This in turn will require the 87c multifunction overcurrent relay to be reset to match the new ratios.
- Bank 10 11T multifunction relay will have to be reset to match the 87c's settings.

9.4 Dauphin - Vermilion Station 230 kV Line Addition Scope of Work

At Dauphin Vermilion Transmission Station, terminate one new 230 kV transmission line to integrate Kelsey Generating Station re-runnering increase into the Manitoba Hydro high voltage system.

Line terminal work for the new line will include the installation of surge arresters, line CVT's, wave traps, motor operated line disconnect switch with associated grounding switch, and synchronizing CVT. A new 230 kV circuit breaker with associated current transformers and disconnect switches will also be installed. Upgrades to part of the upper bus section and risers from upper bus to between breaker disconnects D6A-D6B from 795 mcm to 1272 mcm ACSR conductor. Install new duplex switchboard panel for the line protection.

The apparatus installed will include the following:

1	230kV, MOV surge arrester
2	230 kV, CVT's, line and synchronizing
1	230 kV, switches c/w MOD's and associated grd switch
2	230 kV, breaker disconnect switches
1	230 kV, circuit breaker
1	230 kV, CT's

In addition, the necessary associated grounding, foundations, structures, supports, bus work, cabling and ancillary facilities to connect and control the lines, terminal equipment, breakers, current transformers, switches and other high voltage facilities will be provided.

9.5 New Neepawa 230 kV Station Scope of Work

At Neepawa Transmission Station, terminate one new 230 kV transmission line and sectionalize existing line D54C into the station to integrate Kelsey Generating Station re-runnering increase into the Manitoba Hydro high voltage system.

Line terminal work for the new line will include the installation of surge arresters, line CVTs, wavetraps, motor operated line disconnect switch with associated grounding switch, and synchronizing CVT. Three new 230 kV circuit breakers with associated current transformers and disconnect switches will also be installed.

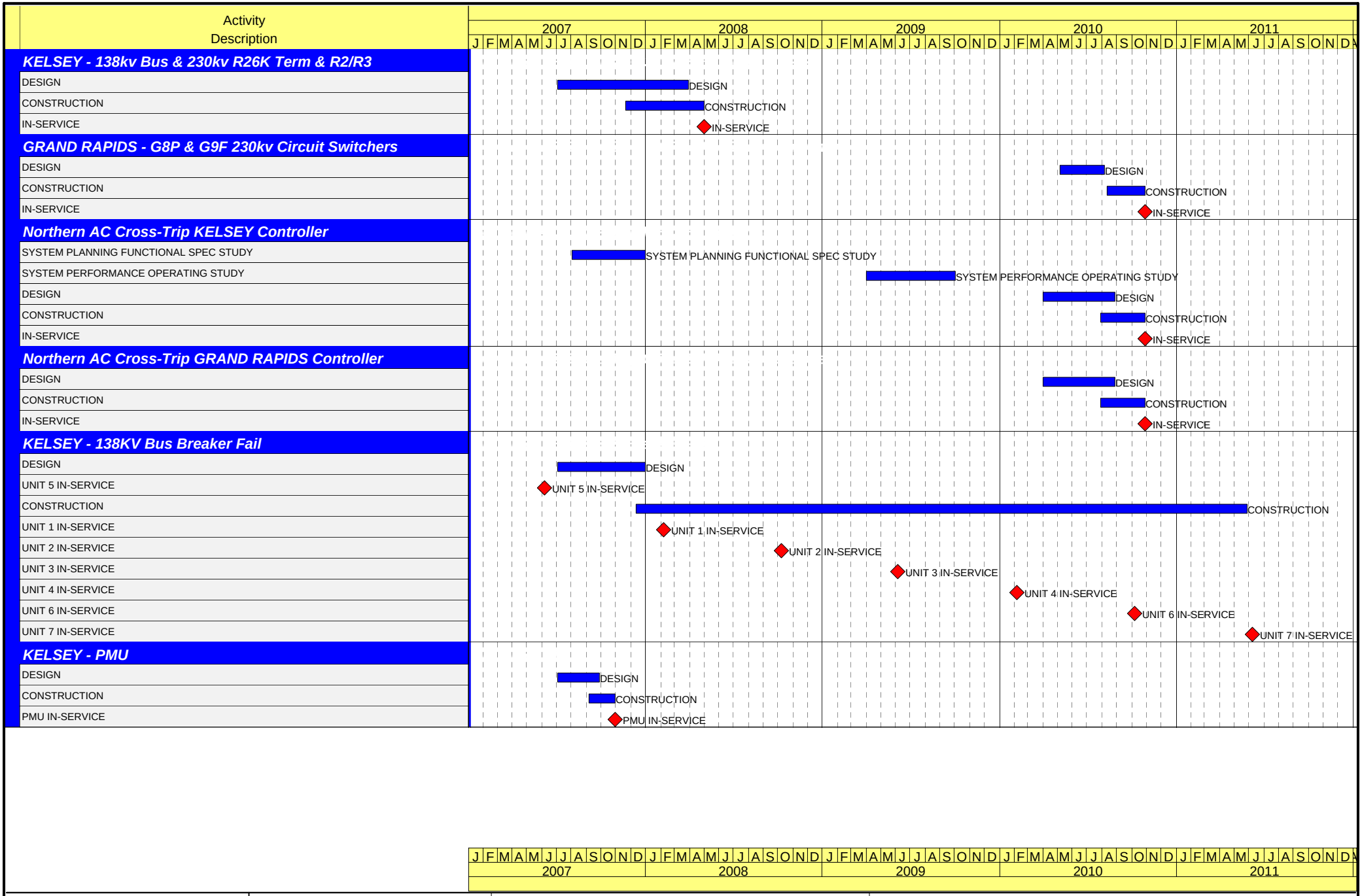
The apparatus installed will include the following:

3	230kV, MOV surge arresters
3	230 kV, CVT's
3	230 kV, switches c/w MOD's and associated grd switch
2	230 kV, breaker disconnect switches
1	230 kV, circuit breaker
1	230 kV, CT's

Two (from Dorsey and Dauphin) of the three new transmission line terminations will require 30 MVAr shunt reactors connected via 230 kV circuit switchers. These were not included in the above estimate but would add approximately $3.5 million to the project. The existing reactor on line D45C at Cornwallis should be able to be moved to Neepawa station, further investigation is required once detailed design begins.

Sectionalization of transmission line D54C and the new Neepawa 230-66 kV station are currently in the 10-year capital plan and are planned to be in-service by October 31, 2011, see budget items below. However, this project may be deferred due to changes in load growth and may not coincide with the completion of the Kelsey Re-runnering project, therefore this work will have to be advanced to facilitate the termination of the new line from Dauphin – Vermilion.

1.1.2.3.20.1		**Neepawa 230-66kV Station**
P:00109	230731	Neepawa Sectionalize 230kV Transmission Line D54C
P:00346	230465	Neepawa Establish 230-66kV Terminal Station
P:00347	230467	Dorsey Protection Changes for Neepawa 230/66kV T/L
P:00348	230468	Cornwallis Protection Changes for Neepawa 230/66kV T/L
P:00465	230961	Neepawa Terminate 66 kV Supply from New 230/66kV Station
P:03003	232086	Telecontrol for Neepawa 230 - 66kV Terminal Station
P:05128	231622/234260	Neepawa 66kV Sub-transmission



Manitoba Hydro

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Prepared By:
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KELS

KELSEY GENERATOR RE-RUNNERING DRAFT Conceptual Schedule

Date	Revision	Checked	Approved