1.0 Introduction

Manitoba Hydro's Rebuttal Evidence addresses the written evidence filed by Whitfield Russell Associates ("WRA") on behalf of the Manitoba Métis Federation with respect to the Needs For and Alternatives To review of Manitoba Hydro's Preferred Development Plan ("PDP"). Through these sections of the rebuttal evidence, Manitoba Hydro will justify the reliability of the proposed PDP.

1.1 Likelihood of Common Mode Failures Impacting Three Bipoles

WRA states the following in MH/MMF/WRA-004a (lines 75-78): "However, the nature of the causes of common mode failures postulated by Manitoba Hydro as a source of extended outages of Bipoles I & II (tornados, wide front windstorms, fire – terrorism and earthquakes were not mentioned) could just as well take out all three Bipoles." In response to this contention, Manitoba Hydro submits that the reliability of the three Bipole system was thoroughly vetted during the CEC proceedings for Bipole III. The 2012 Teshmont study[1] filed in the CEC proceedings indicates that the probability of losing all three Bipoles is significantly reduced based on the final route of Bipole III. In terms of tornado and wide-front wind performance, for example, the risk was reduced by a factor of 200 (i.e. the probability of losing all three bipoles is about a 1 in 3700 years event compared to the loss of two bipoles which is a 1 in 16 years event)[2]. The probability of losing both Bipoles I and II due to excessive wind and ice loading is 1 in 20 compared to a 1 in 200 years return period for losing all three bipoles. Therefore, the planned route and design of Bipole III is such that a common mode failure of all three bipoles is too low a probability to reasonably consider such failure as a credible contingency which must be mitigated under NERC transmission planning standards.

1.2 HVdc System Adequacy Criteria

WRA states the following in MH/MMF/WRA-004a (lines 95-97): "In this NFAT proceeding, Manitoba has implemented a deterministic criterion for adequacy of the HVdc system that is

[1] Weather Hazard and Reliability Assessment for the Preliminary Preferred Route of the Bipole HVDC Transmission Line, January 2012.
[2] From BPIII IR CEC/MH-II-023

less restrictive than it insisted upon in the CEC's Bipole III proceeding." Manitoba Hydro disagrees with WRA's conclusion. Manitoba Hydro utilizes several different criteria, including both probabilistic and deterministic criteria, to ensure the reliability and adequacy of its system. All of these criteria were used in Manitoba Hydro's analysis of Bipole III, though not all of the criteria were specifically addressed in the CEC proceedings. The same criteria have been used to ensure the reliability and adequacy of Manitoba Hydro's recommended PDP. The key criteria include:

- Manitoba Hydro Generation Planning Criteria (NFAT Appendix 4.1) – These criteria include a capacity criterion that ensures a minimum generation reserve of 12% above the demand forecast as well as an energy criterion to ensure sufficient resources are available to supply the energy needs in the event that the lowest recorded river flow conditions are repeated.
- NERC Transmission Planning Standards TPL-001 through TPL-003 – These criteria determine the minimum transmission requirements needed to meet the performance criteria for withstanding credible single and multiple contingencies as defined in Table 1 of the NERC TPL standards.
- HVdc Adequacy criteria – Manitoba Hydro has adopted criteria in addition to the NERC standards that help to plan the HVdc system, including the following.

  (i) Since 1986, Manitoba Hydro has had an HVdc pole over load criterion for determining the supply adequacy in the event of a dc pole outage.

  (ii) Conducting an annual probabilistic reliability assessment regarding loss of load expectation ("LOLE") has also been used as a guideline since 1996, but was added as an explicit criterion in 2012 to comply with new Manitoba regulations governing NERC data reporting requirements. The annual NERC long term reliability assessments require an assessment of whether the Planning Authority can meet a 0.1 day/year LOLE metric[3].

[3] The NFAT Reliability Evaluation included in Appendix 13.1 demonstrates the ability of the alternatives to meet the 0.1 day/year metric.

(iii) In addition, once Bipole III is constructed Manitoba Hydro will require the minimum of one HVdc valve group in on-line spare[4] capability equivalent to the largest valve group above northern generation in a single northern collector system configuration (i.e. 500 megawatts (MW) in on-line valve group spare pre-Conawapa). Manitoba Hydro's initial plans were to have one HVdc valve group in on-line spare capability in each of the two isolated northern collector systems after the construction of Conawapa (i.e. 300 MW spare with Bipole I and 575 MW spare with Bipoles II and III). However the criterion to be applied after the construction of Conawapa is under review.

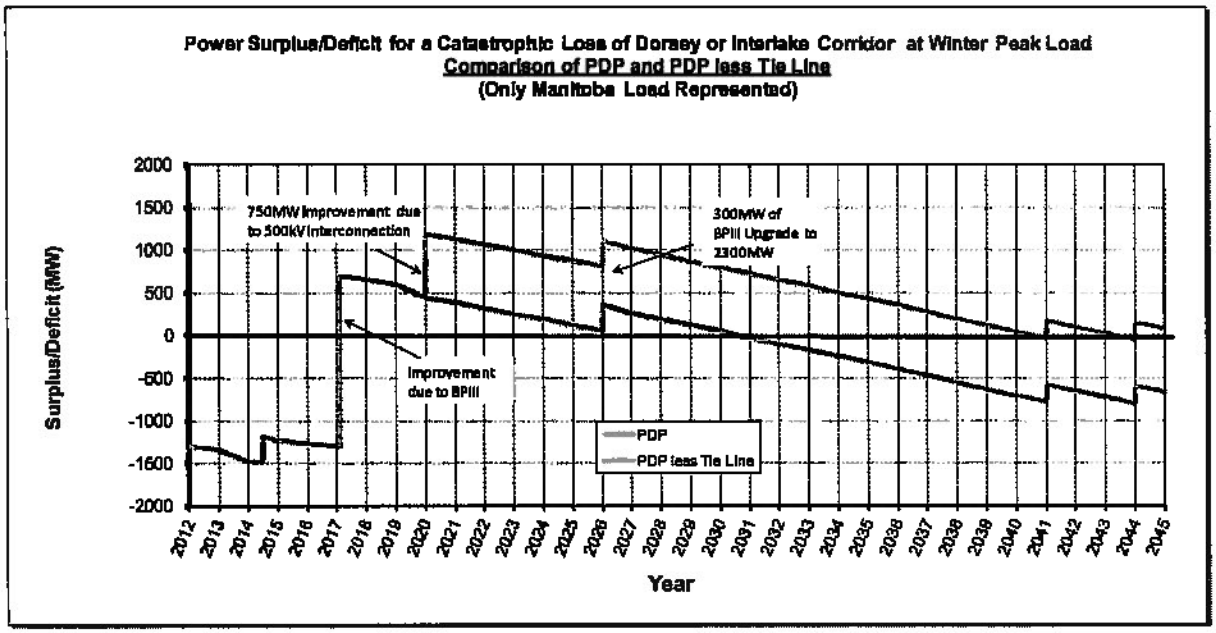
- NERC Standard TPL 004 – In addition to the above criteria, Manitoba Hydro also assesses the risks to reliability of low-probability high-impact events according to NERC Standard TPL-004. This NERC standard requires an evaluation of the risks and consequences of extreme contingencies but, unlike standards TPL-001 through TPL-003, does not require the transmission planner to mitigate such risks. In the context of Manitoba Hydro's analysis of Bipole III, the risk and consequences of the loss of Bipoles I and II were deemed too high by Manitoba Hydro to leave unaddressed. It was estimated that the societal cost following the loss of the two HVdc bipoles in 2017 due to a projected capacity shortfall of 1500 MW could be $20 billion[5]. The Bipole III proceedings focused mainly on the NERC TPL-004 criterion of reliability for low-probability high-impact events.

Contrary to the assertion of WRA in MH/MMF/ WRA-004a (line 135-136), Manitoba Hydro has not substituted its LOLE criterion for the deterministic criterion used in the CEC proceedings. As noted previously and in the NFAT Reliability Evaluation (Appendix 13.1), performing an annual LOLE assessment was added as an explicit Manitoba Hydro criterion in 2012 and has been used as a guideline since 1996. The LOLE assessment does not replace the need to evaluate the risk and consequences of extreme events as per NERC 5tandard TPL-004.

[4] Page 83 of MH's rebuttal evidence, Feb. 28, 2014; on-line valve group spare will be required in 2017 after BPIII. The pole over load criterion will be retired around the same time.
[5] From BPIII IR CEC/MH-II-023

WRA states the following in MH/MMF/ WRA-004a (lines 111-112): "...Manitoba Hydro does not intend to comply with the deterministic criterion it espoused in the CEC proceeding on Bipole III." While the NFAT proceedings have focused on other criteria, an assessment of the ability of the PDP to serve Manitoba load during the loss of Bipoles I and II was in fact conducted. The figure below indicates the ability of the PDP to supply Manitoba load to 2045. In 2041 and beyond, it is assumed gas turbines will be added in southern Manitoba to supply future load growth and ensure minimal power deficits.

FIGURE 1: POWER SURPLUS/DEFICIT FOLLOWING LOSS OF BP I/II AT WINTER PEAK.



A key component of the PDP that ensures reliability for this extreme event is the addition of the 750 MW tie line. Without the tie line, a deficit is expected as early as 2025[6]. This deficit was also identified in the Bipole III CEC proceedings.

1.3 Import Capacity

WRA contends in MH/MMF/WRA-004a (lines 130-133) that "...Manitoba Hydro will be deficient in import capacity under its assumptions for 2019/2020 and 2020/21 if Keeyask enters service

[6] From BPIII IR CEC/MH-VII-417

on schedule but completion of the second 500 kV ac line is delayed." This conclusion is unfounded, as Manitoba Hydro's calculations shown in Figure 1, demonstrate that a delay in the new 500 kilovolt (kV) tie line of one year will not result in a power deficit.

1.4 Cost of Firm Imports

WRA states the following in MH/MMF/ WRA-004a (lines 118-123) : "...under the Preferred Development Plan, Manitoba Hydro does not plan to buy enough firm imports to cover the capacity shortfall in the event of a loss of Bipoles I & II.... By not including in the Preferred Development Plan the cost of purchased power needed to meet the criteria it developed for the CEC proceeding, Manitoba Hydro has adopted a laxer criterion and made the Preferred Development Plan appear to be less costly. " In response, Manitoba Hydro submits that it has not adopted different criteria, nor laxer criteria, since the CEC proceedings. Furthermore, with respect to the cost analyses in the CEC proceedings versus the NFAT proceedings, WRA is comparing apples to oranges.

In analyzing alternatives to Bipole III, Manitoba Hydro included an analysis of the cost of an import option under a hypothetical "import only" transmission line scenario. For this alternative, Manitoba Hydro's estimate included the cost of building gas turbines in the U.S., as an "import only" transmission line must be connected to some form of firm generating capacity. Thus, the capital cost of relying on imports was considered equivalent to the capital cost of building gas turbines in Manitoba with the added cost of building the interconnection, and was estimated at $4.5 billion (2017 in-service cost). The gas turbines were estimated to cost $3.0 billion, and the interconnection $1.5 billion. Due to the incremental cost of the interconnection, the total cost of the import option was considered significantly higher than the cost of building gas turbines in Manitoba.

In contrast to the import option analyzed in the CEC proceedings, the PDP does not include an "import only" transmission line, or the associated costs of constructing a gas turbine in the U.S. Because the proposed 750 MW tie line in the PDP can be justified by Minnesota Power as

necessary to supply Minnesota load, it has a high likelihood of being approved by the MPUC. The proposed transmission line will have the added benefit of providing firm import transmission to Manitoba. As a result, Manitoba Hydro will be able gain access to surplus energy from the MISO market at essentially no incremental capital or operating costs. There will only be variable costs associated with the cost of energy needed to supply Manitoba load in times of unexpected outages.

Manitoba Hydro has purposely not included potential reliability costs or benefits of avoiding load shedding following loss of Bipoles I and II in its analysis of alternatives in the NFAT proceedings in order to avoid claims that Manitoba Hydro is inflating the value of the PDP. A conservative estimate of the reliability worth of the PDP compared to the all gas plan was given in Chapter 13 of NFAT as $101 million but was not included in the overall monetized net benefits.

1.5 Compliance with NERC Standard TPL-002

In its response to MH/MMF/WRA-004b, WRA contends that note b from NERC Standard TPL-002-0b does not permit the curtailment of Firm Transfers following the loss of a single pole to prepare for the next contingency. However, such a position is inconsistent with the clear wording of the existing standard and the clarified version of the standard which has been developed by NERC and approved by the U.S. Federal Energy Regulatory Commission ("FERC") to come into effect over the next year.

While note b of the standard does contain a provision directed at interruption of supply to radial customers and local network customers, Manitoba Hydro does not rely on this provision of footnote b. The temporary curtailment of firm transfers by Manitoba Hydro following loss of a single pole would not lead to the interruption of supply to any customers, since Manitoba Hydro is able to call upon contingency reserves from MISO. Manitoba Hydro relies on a separate provision of note b governing curtailments of contracted Firm Transfers which states that "To prepare for the next contingency, system adjustments are permitted, including

curtailments of contracted Firm (non-recallable reserved) electric power Transfers." Since this provision has no mention of radial customers, it would be unreasonable to interpret note b as only allowing curtailment of radial customers, as suggested by WRA. WRA appears to erroneously equate curtailment of Firm Transfers with interruption of supply.

It is also important to note that NERC has spent considerable time clarifying TPL-002, including note b, in response to FERC Order 693. The new consolidated version of standards TPL-001-003 is TPL-001-4. This version, which was approved by FERC Order 786 on December 23, 2013, contains the equivalent curtailment provision in note 9 and has no reference to radial customers. Note 9 states: "Curtailment is allowed both as a System Adjustment and a corrective action when achieved through appropriate redispatch of resources obligated to redispatch, where it can be demonstrated that Facilities internal and external to the Transmission Planner's planning region remain within applicable Facility Ratings and the redispatch does not result in any Non-Consequential Load Loss." Accordingly, the new version of the standard also supports Manitoba Hydro's position that curtailment of firm transfers is permitted when achieved through redispatch of resources, such as the delivery of contingency reserves.