Rebuttal to the Coalition Report The Bipole III Transmission Project Location Options for Bipole Converter Station near Winnipeg Part 1 and Part 2

By Manitoba Hydro, March 5, 2013

The proposal by the Coalition, in MH's assessment, has significantly increased costs, reliability risks and imposes greater risks generally relative to the BPIII project.

Report Part 1 recommends:

- relocating BPII converter at Dorsey to Riel by installing new converters with a project in-service date of 2017, and
- delaying the BPIII project to 2025.

MH disagrees with relocating the BPII converters in the absence of prior completion of BPIII. Without BPIII there is inadequate spare transmission necessary to accommodate such an operation. In addition, Report – Part 1 dismisses the risk to reliability for the loss of BPI and II corridor through the underlying assumption that load reduction of up to 800MW of load shedding can be exercised during winter months, and that on the supply side imports from U.S. can be increased to 1200MW. MH disagrees with these assumptions as the assumptions could result in extensive periods where significant load would be exposed to rotating blackouts during the extremely cold Manitoba winter months.

Report Part 1 assumes:

- That MH would also have to build a new $4.18B north-south 500kV ac line by 2025 to meet its reliability needs, in addition to implementation of MH's proposed BPIII plan.

This assumption is incorrect; MH's development plans do not include such a proposal.

Report Part 2:

- Supports the proposal in report-Part 1 to relocate BPII to Riel prior to building the BPIII project.
- Minimizes the risk and complexity of separating the controls and other technical concerns.
- Advocates that MH has overstated the impact of simultaneous loss of BPI & II transmission lines
- Suggests that MH overstated the emergency HVdc line restoration effort.
- Proposes an incomplete paralleling scheme.

- Proposes Laverendrye as the site for the BPIII southern converter without addressing the reliability and technical issues that would have to be resolved in the ac and dc systems were this to be done.
- Proposes a plan for transmission out of Laverendrye that is vague.

MH disagrees with the above. Specific points of disagreement are as follows:

- As mentioned in the context of Report-Part 1, MH would not contemplate the risk of moving BPII to out of Dorsey in advance of a prior established BPIII.
- The local experts Report-Part 2 suggest as the ones that could aid in the transitioning of the BPII out of Dorsey are the same experts who, earlier, have advised MH against moving BPII out of Dorsey without prior establishment of BPIII.
- As stated in Manitoba Hydro testimony on November 22, 2012 during the CEC hearings and as described in detail below, Laverendrye, for a variety of reasons, is unacceptable as a termination point for BPIII and any site near Laverendrye would be more expensive to implement than the Riel site.

The planning and design of a three Bipole system operating in the 'Manitoba Hydro ac System, which is characterized by low inertia and low short circuit strength (relative to the HVdc loading) has to be done diligently supported by a variety of technical simulation studies.

1 Cost

MH has many concerns with the Coalition proposals. There are omissions in the cost break down in Appendix 3 Report-Part 1. Without the following cost elements, the Coalition proposals (d) and (e) cannot be completed as proposed in Reports Part 1 and 2.

- Cost of the Laverendrye 500kV station
- Cost of the 500kV ac line from Laverendrye to Riel
- Rerouted BPII line to Riel would have to be an U/G cable to be comparable in reliability to the paralleling scheme of BPI&II in the existing system. Therefore the costs are revised to reflect the 50km, U/G cable cost. For the same reason, the 70km HVdc paralleling line cost is added to the CEC scheme.

MH offers the following revisions to the cost table in Appendix 3, by adding the above elements in GREEN. All non-GREEN text and numbers are as in Appendix 3 of the Coalition Report-Part 1.

Revised Appendix 3 of Report-Part 1 -
MH Revisions (missing components and estimate corrections) are in GREEN

PROJECT COMPONENT (2017 $)	ALT(b) CEC scheme	ALT (c) MH-BPIII	ALT(d) & (e) Coalition Scheme
Keewatinoow Converter Station and 230kV Switchyard	920	920	920
Bipole III Western Route T/L line (line, property, licensing)	1121	1260	1145
Dorsey new Bipole III converter stn and associate ac system upgrades	889	0	0
Laverendrye BPIII converter station	0	0	889
Laverendrye 500kV ac station + 500kav line termination (MH addition)			117
Laverendrye-Riel 500kV ac line termination at Riel (MH addition)			6
New 500kV ac line from Laverendrye to Riel (MH addition)			84
Dorsey Bipole II Valve Replacement, Smoothing Reactors, Transformers		272	
Henday Valve Replacement, Smoothing Reactors, Transformers (543.6 ˙/. 2)	272	272	272
Outage Costs*	100	0	100
New Riel Converter Station and 230 kV Switchyard	889	889	889
Reroute of Bipole II line 100kM	92	0	0
Reroute of Bipole II line 50km assuming U/G for BPI&II paralleling comparability -(MH addition)	0	0	370
70km HVdc Line and Modification for Bipole I & II paralleling -(MH addition)	75	0	0
Ac system upgrades (north and south, item #11 above)	211	211	211
Subtotal in 2017	4569	3280	1631
Subtotal In 2019	0	544	0
Subtotal In 2025	0	0	3372
TOTAL in 2017$	4569	3824	5002

The most significant unsubstantiated assertion in Report-Part 1 is *"……. the requirement for an additional new 500 kV ac line by 2025 which will be needed in the Manitoba Hydro proposal;…." - page 1-1*.

MH has not indicated the need for an additional 500kV ac north-south line for reliability by 2025. It is not an item identified in MH capital plan.

MH has made references to a north-south 500kV line in two instances, in the material provided. Once in the context as an alternative to BPIII as acknowledged by Mr. Derry in *"Manitoba Hydro has examined construction of a 2000 MW double circuit 500 kV alternating current (AC) line, which would be required to provide compatibility to the alternative of Bipole III….." - page 1-9.*

In the second instance, it has been in the context of future transmission for generation beyond Keeyask and Conawapa generation, in the MH report 'Ultimate HVDC Development in Manitoba'. This report however does not specify the nature of this future north-south ac line with respect to voltage, capacity, configuration or cost. It is also not in the time frame of 2025 as asserted in Report-Part 1.

In response to IR CEC/MH-VII-417, where MH was questioned on reliability beyond 2025, Manitoba Hydro responded that 'the solution for reliability will depend on future Manitoba Hydro development plans'. For example, should Manitoba Hydro proceed with the preferred development plan of Keeyask and Conawapa, and a new 500 kV export tie line, the existing firm MH-US import capability will increase initially by 750 MW and subsequently by 1100 MW. This increased firm import will address reliability concerns until, 2040 or 2050, dependent on future load growth.

This assertion in Report-Part 1 has resulted in the erroneous addition of a $4.18B cost to both the MH-BPIII project and CEC schemes in TABLE 1, artificially inflating their costs to $8.0B and $8.53B respectively.

The table below provides the corrected capital cost comparisons with the removal of the new $4.18B north-south 500kV ac line as it is not in the Manitoba Hydro plan.

TABLE 1 Capital Cost Comparisons - Corrected by MH, corrections are in GREEN

All costs 2017 billions of dollars **Bipole Locations**	CEC ALT (B)	MH ALT (C)	Coalition (D) & (E)
Bipole II @ Riel	1.43		1.63
Bipole III @ Dorsey	3.14		3.37
Bipole III @ Riel		3.28	
Refurbish Bipole II		0.54	
Bipole III @ near LaVerendrye			
North South 500 kV Line Compatibility	NONE	NONE	
Total	4.57	3.82	5.00

2 Recommended Proposal (d)

Report-Part 1 recommends proposal (d) *"(d) Relocate the converter station for new Bipole II to Riel."* - *page 1-7*, based on the assertions that:

- The risk associated with the loss of the BPI & II lines is insignificant.
- The risks associated with the BPI and II separation project without adequate spare transmission are insignificant.

The recommendation (d) dismisses the reliability risks associated with the BPI and II Interlake corridor which has the higher probability of loss according to the Teshmont studies reported in the EIS chapter 2 (see EIS chapter 2, IRs CEC/MH-VI-338, CEC/MH-VII-384). Also this recommendation does not address the significant risks associated with carrying out the BPI and II separation project without having adequate spare transmission to cover the planned and unplanned outages that would be experienced during the project.

Because proposal (d) does not address the loss of the BPI/II lines, MH believes that it is not acceptable and should not be implemented before BPIII is in service because of the excessive risk to reliability. Despite this reduced reliability of proposal (d), the Report-Part 1 claims it to be a substitute for the Bipole III and proposes to delay the Bipole III project until 2025. The technical details of the proposal (e) recommended and explained in the Coalition Reports Part 1 and 2 are very dependent on the relocation of the BPII converters to Riel prior to BPIII being implemented. Therefore the Coalition proposal (e) is also not acceptable.

2.1 Reliability Risk of the BPI and II Corridor Loss

Report-Part 1 dismisses the reliability risk of the BPI and II corridor loss by the assertion that MH had overestimated the deficit in supply for the loss of BPI and II corridor loss. This assertion is discussed under the topic *"Corridor outages of the existing Bipole I and Bipole II transmission lines"* - *page 1-12,* where the load variations in the off peak hours are discussed. Most of the discussion is on the load side of the deficit equation. The limited discussion of the supply side rests on the erroneous assumption that there is 1200MW of import power available: *"the author has assumed that an additional 300 MW of import, that is 1,200 MW rather than 900 MW, would cover this during these months."* - *page 1-17.* There

is also an assumption that 800MW of load shedding can be used in this scenario: *"In addition, as mentioned earlier that 800 MW of load shedding is available."* - *page 1-17.*

The shedding of Manitoba load is considered to be part of the overall protection for massive supply loss and would be employed as required in the form of rotating blackouts. Load shedding is considered the "do nothing" scenario and is the very event Manitoba Hydro is planning to avoid, to the extent possible, with the recommended construction of Bipole III, given the extreme hardship to the Province of extended electricity outages especially during the frigid winter months.

The import assumptions suggested in Report-Part 1 are also incorrect. The import capabilities from the U.S. and neighboring provinces are 900MW, and are based and limited to 700MW firm and incremental 200MW non-firm. The suggested 1200MW import is not achievable for the time duration of outage contemplated for a corridor loss. See IRs CEC/MH-V-149, V-150, VII-370, VII-372, VII-422, VII-423.

The Report-Part 1 gives insufficient consideration to the likelihood of generator unavailability such as those located on the Winnipeg River and at Grand Rapids. MH believes that even MH's deficit forecast is optimistic as it assumes nameplate generation is available, which is seldom the case as stated in the EIS filing. As such the assertion on deficit, for the loss of the BPI&II lines is too optimistic and does not comply with Manitoba Hydro's mandate and obligation to serve load.

Part 2 of the report minimizes the effort and time required for line restoration in the event of a catastrophic failure of the BPI &II lines.

In Report-Part 2 the effort required to access the failed site, supply materials, install foundations and anchors, erect towers, and string conductors following a catastrophic failure of lines, most likely in frigid weather conditions, is misunderstood or underestimated. The report compares the effort and time of emergency line restoration to that of installing recorders and video cameras in summer weather. *"This author, when Executive Director of the Manitoba HVDC Research Centre, was involved in implimenting a series of video cameras and long playing recorders on the DC towers in northern sections of the Bipole I and II transmission lines during several summer periods"* - *page 2-14.*

Then the report goes on to state that *"The challenging terrain of the northern right-of-way was not a major issue in this exercise, and certainly nowhere near to the extent Manitoba Hydro makes out the problem to be."* - *page 2-14*. Obviously the terrain is a concern when moving heavy construction equipment, and carrying out activities associated with transmission rebuilds.

"This would imply that if a good inventory of tower, insulator and conductor is available, operation could be returned in days not weeks." -*page 2-13*, suggests that the restoration could be done in days and not weeks.

If an event similar to 1996 were to occur in a northern remote location, there are many factors that could extend restoration time, potentially even beyond 8 weeks. In such a scenario initial clearing of the damaged line would be completed by hand without equipment, simply because of the delay to bring in equipment. Unlike in 1996 where the sites were easily accessible, ground access could be a major problem in late November and December. Wet ground conditions, with no frost makes vehicle access a problem. Road building becomes part of the response. To make matters worse the days are shorter. Setting up a remote camp would take time. Often this type of emergency presents unforeseen challenges for which instant solutions have to be devised, all of which impacts the restoration time. (Also see IR CEC/MH-VII-384, CEC/MH-VII-441, CEC/MH-VII-442)

The rest of the argument discusses the use of helicopters for line restoration work where it ends with a recommendation of investing in a Sky Crane, *"Since Manitoba Hydro is willing to expend $3.28 billion for reliability, the lease of a Sky Crane would be a worthwhile investment …"- page 2-13*. The Sky Crane presents logistical problems of fuel delivery. They consume a large amount of fuel, and keeping up with its fuel demand can make it potentially unsuitable for remote locations. They work best for very short haul distances.

Also, there are circumstances where getting down on the ground is unavoidable. Existing foundations may not be re-usable due to irreparable damage, or the foundation would have collapsed due to water levels. Failed anchor systems would require new anchors. Consequently ground access is required. A helicopter can assist, but cannot deal with the entire restoration.

Report-Part 2 asserts that ice storms are unlikely to impact the BPI&II lines in the northern rights-of-way due to being tree lined. *"Similarly severe ice events in these tree-lined northern rights-of-way are also unlikely …" – page 2-14.* No data is presented by the Coalition to suggest such assertions are accurate and extreme events in the north and tree lined areas are still a real possibility. MH has filed three expert studies on weather related risks to the Bipole lines.

2.2 Risk in separating the BPII converters and relocating to the Riel station without adequate spare transmission

Report-Part 2 asserts in several ways that separating the BPII converter and relocating it to the Riel station can be done with insignificant risk. The report overlooks the significant risk of doing this in the absence of having spare transmission.

The observation "*so disconnecting the controls and protections between the two Dorsey converter stations is not a formidible task*" - *page 2-7,* suggests that MH has been misunderstood. MH did not suggest the task of designing new controllers itself to be formidable. It is the need for planned outages the risk of unforeseen outages during this exercise without the benefit of adequate spare transmission that is the concern when one has the obligation to maintain service to load.

In a similar vein Report-Part 2 observes that: *"Teshmont Consultants assisted by an HVDC equipment supplier and Electranix Corporation of Winnipeg are developing the designs for a very complex set of controls, protections and communications, far more complex than what exists with the four converters of Bipoles I and II ……"* - *page 2-11.* Developing the designs for the controls of a brand new project that is yet to go in service is a very different task than taking on the proposed separation of BPI & II controls. Designing controls for a brand new project does not require juggling the outages and risks associated with the proposed separation of BPI & II (the backbone and the heart of the MH power system).

In response to the statement "Manitoba Hydro, Teshmont Consultants, HVDC equipment suppliers and others here in Winnipeg have the technical skills ….." - *page 2-11*, MH notes that the foregoing consultants and others in Winnipeg with technical skills cautioned MH about the gravity of the risks in separating BP I &II without adequate spare transmission.

On pages 2-3 of Report-Part 2, one reads: *"The Manitoba Hydro response to the CEC on the question of relocating Bipole II inverter to Riel completely ignored this "key finding"* (desirable goal of splitting BP I and II) *without any substantial technical justification for doing so."* - *page 2-3*. On January 28, 2013, MH provided a response to a series of precise questions posed by the CEC. The CEC did not ask MH to identify a third site for a southern converter station. Accordingly, MH was not ignoring a "key finding" regarding the Dorsey Converter Station, but simply responded to the question that was asked.

2.3 Paralleling of the Bipoles I and II following Relocation of BPII to Riel

Report-Part 2 discusses the paralleling of the Bipoles I and II following relocation of BPII to Riel, in support of establishing the premise that *"the need for a second DC transmission line between Dorsey and Riel as Manitoba Hydro stated will not be necessary"* - *page 2-7.* It states that *"DC transmission from Dorsey to where the line section that taps off the Bipole II line to Riel should remain in service to continue to accommodate paralleling with Bipole I as presently constituted."* - *page 2-6*. MH does not take issue with keeping the 'line section that taps off the Bipole II line to Dorsey' in service. The concern MH has is that in the absence of a dc connection from Dorsey to Riel, there is no paralleling to deal with a failure of

the proposed 100 km portion Bipole II line from the tap off point to Riel. The absence of the ability to parallel given loss of the line segment from Riel to the tap-off point leaves the proposed relocation of Bipole II to Riel less reliable than what is currently available. If the dc connection from Dorsey to Riel proposed by the writer of Report 2 is to be an underground connection, which is not clear in the report, MH acknowledges that the weather related risk of failure would be reduced, but the cost and challenges of constructing an underground link of some 50km would have to be included in the proposal. The cost of such an underground connection is not included in the costs set out in Report – Part 1. MH has included the cost of the U/G cable from Dorsey to Riel in section 1 revised Appendix 3.

2.4 Clarification of Resonant Frequencies

"Resonant Frequencies on the Bipole III Transmission Line. This concern by Manitoba Hydro is not a significant factor but presented as if it is." - *page 2-5*, appears to be a misunderstanding on the part of the author. The context in which the resonant frequencies on the BPIII transmission line was described in the response to CEC in Jan 2013, was where the BPIII lines is considered to be directly connected to either of the existing BPI or II converters at Dorsey without any modification to the converter. Manitoba Hydro has described the resonant frequencies of the BPIII line to indicate that they are different from the resonances that are there in the shorter (by about 500km) BPI or BPII lines. Therefore modifications would be needed at the existing Dorsey BP I or II converter to make it compatible with the longer BPIII line length. MH has studied these resonances and the need for mitigation. The modifications required are extensive, as wholesale changes are required to the dc control and protection systems, wholesale changes are required to the dc filters, all adding significant risks to the operation of the HVdc system. Therefore the point that was made in the January 28th 2013 response to the Commission is that BPIII line could not be connected to either of the existing Dorsey converters without significant risk and cost.

3 Recommended Proposal (e)

The Coalition proposal entails:

"(e) Build a converter station for Bipole III in the vicinity of LaVerendrye (Report Recommendation)" for the year 2025. *"The proposed route in the Report would follow the CEC route from Westbourne to a point 40km from the existing Bipole I and II corridor where it would then turn in a south-east direction to a point near LaVerendrye, (~105km)" – Page 1-3.*

MH disagrees with deferring BPIII to 2025. MH also disagrees with locating the southern termination at Laverendrye. Along with the significant cost, Laverendrye is the wrong location due its proximity (electrical and geographic) to Dorsey.

3.1 Converter at Laverendrye

Report-Part 1 recommends locating the BPIII converter at Laverendrye *" The second component of the Recommendation locates Bipole III in the south-west corner of the city of Winnipeg near the current Manitoba Hydro station at or near LaVerendrye.*" - *page 1-11*.This recommendation to locate the BPIII southern converter near Laverendrye provides no discussion on its technical implication to the ac and HVdc systems.

The main issues are as follows.

3.1.1 Geographical Separation

The geographical separation between Laverendrye and Dorsey (approximately 21km) is not adequate. Storm track of downbursts that have been investigated showed up to 25 downbursts clusters inside a damage path of about 27km. Bipole III was designed to resolve the power concentration at a common location. Locating Bipole III at a site close to Dorsey leaves it still susceptible to common mode wind events. The Laverendrye location is even more concerning if the BPII converters remain at Dorsey.

3.1.2 Laverendrye Station issues

First , siting the Converter at Laverendrye would require rebuilding of the 230 kV station and the site would have to be expanded to build the dc station as mentioned in Mr. Neufeld's testimony (Nov 22nd,2012). Laverendrye ac station does not have enough capacity to handle 2000MW of power and would have to be significantly expanded. Both expansions requiring acquisition of additional private farm land. The ac station would have to accommodate the 2000MW as well as the 230/500kV station according to the Coalition proposal. Mr. Neufeld, in his November 22 testimony clearly explained that additional transmission would be required from Laverendrye, would have to be added to move new Bipole III power to the load. The cost component of the 500kV station is ignored in "*TABLE 1 Capital Cost Comparisons*" - *page 1-20.* Please see the corrected costs in section 1 – Table 1.

3.1.3 Multi-infeed issues

Secondly, a detailed study is required to evaluate and mitigate the multi-infeed effects that are referred to in Report-Part 2 *"The multiple infeed issue is a factor with conventional (LCC) inverters that are in close proximetry where a disturbance in one Bipole may transfer to a disturbance in the other Bipole(s)" - page 2-7.* 'Close proximity' is the electrical proximity that is determined by the parameters of the transmission lines connecting the stations. Siting of BPIII at Laverendrye is electrically in very close proximity to Dorsey and it is most problematic, especially if the BPII converter remains at Dorsey. While LCC technology would present greater challenges in maintaining the required system performances, even VSC technology would present a significant challenge due to the electrical proximity.

It appears the technical difficulties that arise out of the converter siting in the Coalition proposal are acknowledged in Report-Part 2 by the suggestion that one could use VSC technology for the BPIII converters to mitigate the potential multi-infeed problems, *" This is much less likely to occur in a voltage sourced inverter." - page 2-8.* Then there is also the suggestion that the VSC technology is most likely to be ready for the BPIII application in 2025: *" If Bipole III inservice is delayed, there is an increased likelihood that it would be constructed with voltage sourced converters.." - page 2-7.*

The Coalition proposal to locate the converter for Bipole III at Laverendrye, creates a different multi-infeed configuration. It can lead to HVdc system recovery performance issues which may result in higher costs such as requirement for additional synchronous condensers.

3.2 500kV ac Transmission from Laverendrye to Riel

The Coalition proposal (e) uses a 500kV ac line to transmit power from Laverendrye to Riel according to "*Figure 2-3" - page 2-8* of Report-Part 2. Despite the comment: *"This future second 500 kV AC transmission line will follow the available right-of-way south of Winnipeg as shown in Figure 1-1….. If this is indeed a viable and possible plan, then this second south route 500 kV AC transmission line would provide termination for the Bipole III at or near LaVerendrye substation….." - page 2-11*, the proposal for the 2000MW of transmission out of Laverendrye is vague. The future second 500kV ac ring line that this report refers to has only been considered conceptually as part of the future tie line to the U.S. It is not part of the MH capital development plan. Should this 500kV ac line be proposed for the outlet transmission from Laverendrye the cost needs to be included as part of the Laverendrye converter site cost (please see the correction to cost in section 1). The line would also require an environmental assessment and license.

As explained by Mr. Neufeld in his testimony on November 22, 2012 Dorsey Station is the primary supply for serving load in southern Manitoba. The greater concentration of load is to the east of Red River in the Winnipeg area. Consequently, the concentration of power flow is from Dorsey in a west to east direction. Termination of Bipole III in the vicinity of Laverendrye increases the west to east loading on many existing transmission lines to near capacity, and would require expansion of the west-east transmission capability. The export flow further increases this loading on the west-east transmission. Additional transmission from the proposed Laverendrye converter across to the east on the south side of Winnipeg therefore cannot be avoided.

It is not clear in "*Figure 2-3" - page 2-8,* or in the discussion, if the 500kV ac line is only from Laverendrye to Riel or is to be extended to Dorsey station. If the proposal is for this 500kV line to be extended to the Dorsey station, that would further shorten the 'electrical distance' between Dorsey and Laverendrye stations. Such electrical proximity would result in worsening the multi-infeed issues that were discussed earlier in section 3.1.3, which would have detrimental implications on system performance and on project cost. On the other hand, if the proposal is to have only the line segment between Laverendrye and Riel then there are more loading impacts during an outage of that line.

Neither Report Part 1 nor Part 2 discusses what would happen during an outage to the 500kV ac line. NERC (North American Electric Reliability Corporation) standards require that following a contingency of a single element (500kV ac line in this case), the interconnected system should not result in failure to meet performance criteria such as voltage and line loading must remain within ratings, with no loss of load and with no cascading of other network lines.

In the event of a loss of the 500kV ac line, the power will naturally flow out to the other 230kV and 115 kV lines out of Laverendrye and potentially result in overload and potential cascade tripping. Such a disturbance is a violation of the NERC standards. It is this type of scenario that led to the 2003 blackout in the eastern U.S. and Ontario. Therefore, adequate Laverendrye outlet transmission is necessary to mitigate such overloads, as described by Mr. Neufeld in his testimony on November 22, 2012. MH believes that multiple 230kV ac lines would be required and would be more costly than the proposed Bipole III HVdc line into Riel.

4 Line Routing and Impact on Project Schedule

The Coalition proposal has three new line segments that would require a new licensing process. According to the Coalition proposal the two stages (d) and (e) are scheduled for 2017 and 2025, 8 years apart. Given the 8 year separation in the two stages (d) an (e) it is most likely that there may likely have to be two separate licensing processes for the new line segments associated with each stage.

The Coalition proposes an ISD of 2017 for stage (d). MH believes that 2017 ISD cannot be met. To implement stage (d) the line segment between the tap-off point of BPII line and the Riel station would have to be licensed and would require 2-3 years. .. On a turn-key basis the procurement, engineering and construction of the Riel converter will take 3 years from date of commitment.

If this segment of line was to be U/G cable it would further delay the ISD. Please refer to the MH rebuttal to the Cable report by the Coalition.

Stage (e) has the rerouted BPIII line segment and the new 500kV ac line south corridor for licensing.

5 Conclusion

MH concludes that the Coalition proposal is more costly than MH's proposed BPIII project.

The Coalition's proposal would delay the ISD of the BPIII to 2025, which is unacceptable to MH.

The Coalition proposal does not address the BP I & II corridor loss until 2025. This is unacceptable to MH.

The Coalition proposal entails moving BPII converters without back up transmission. This again is unacceptable to MH.