

Manitoba Hydro Group TSR Study

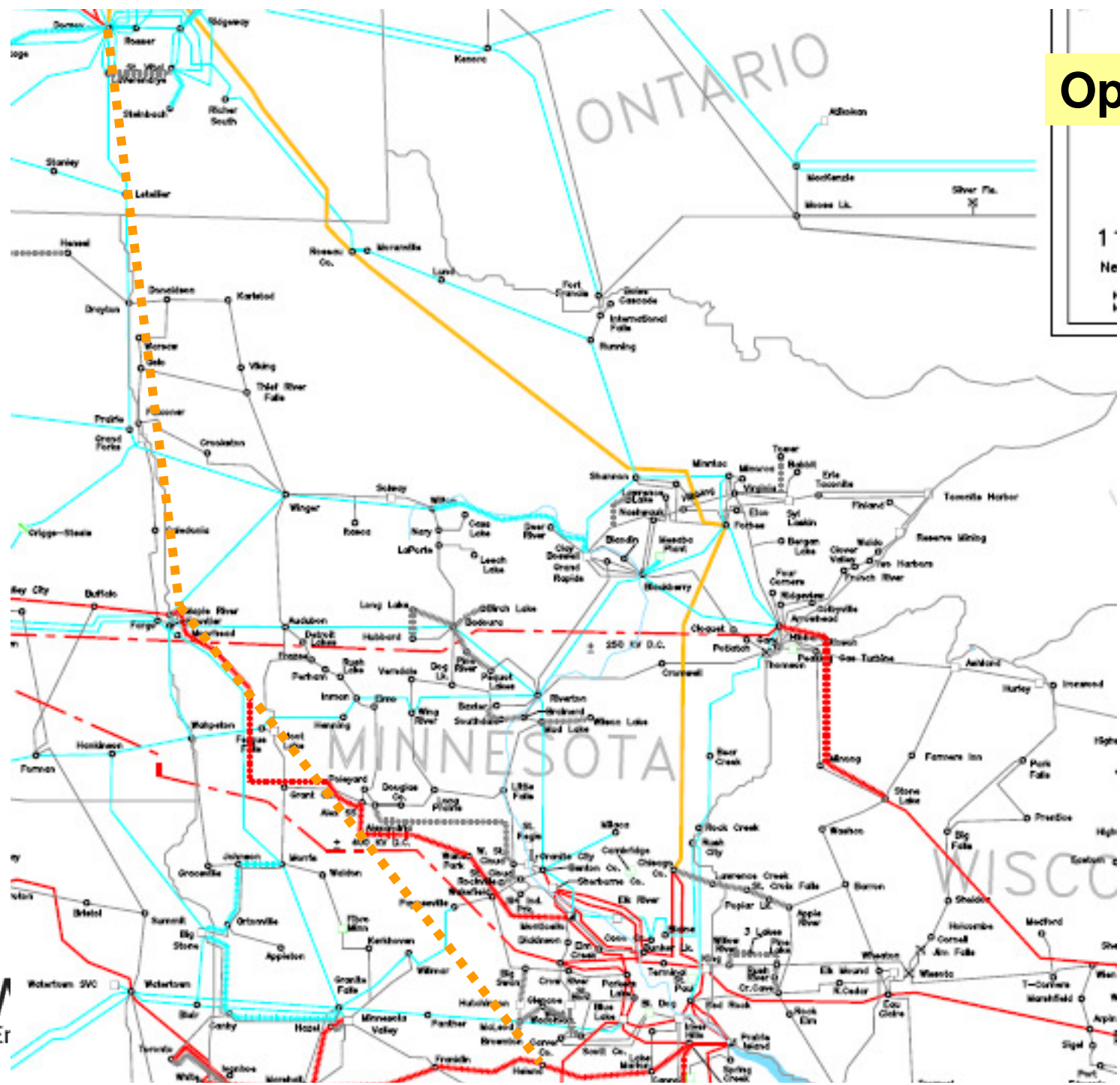
Transmission Options
October 2008

Proposed Transmission Upgrades

Option 1

- Dorsey - Maple River - Helena 500 kV
 - 500 kV single circuit with series capacitors (located at Prairie), with HVDC reduction for the loss of the line
- Dorsey – Riel 500 kV
- North La Crosse – West Middleton – Rockdale 345 kV (ATC proposed facility with 2013 ISD)
- An additional sensitivity would consider tapping the line at Prairie (345 kV).
- Option assumes use of Helena - Lake Marion – North Rochester – North La Crosse 345 kV CAPX 2020 facilities

Option 1



Midv
Er

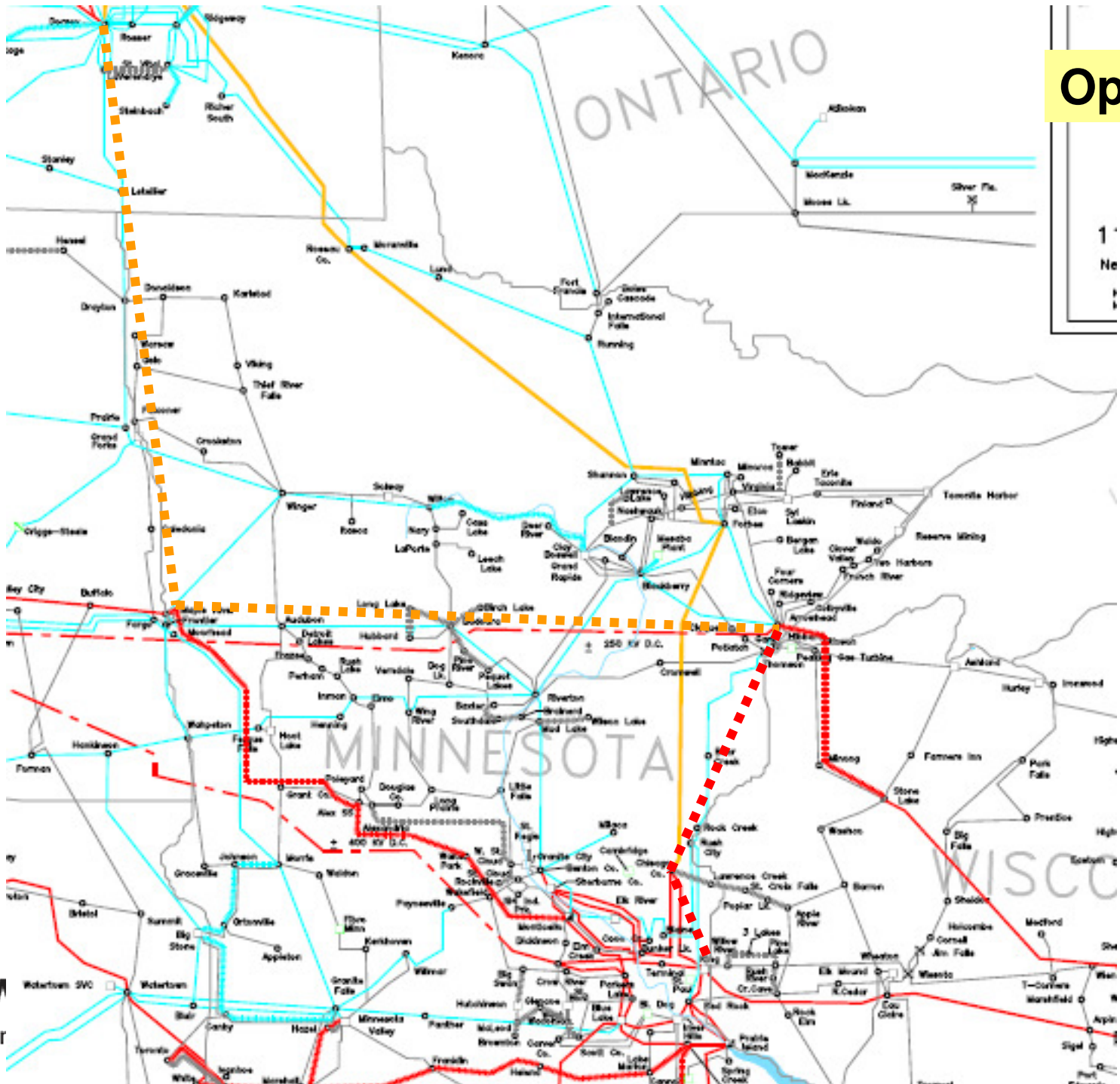
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Proposed Transmission Upgrades

Option 2

- Dorsey – Maple River 500 kV
 - 500 kV single circuit, series compensated; series capacitors located at Prairie; HVDC reduction for the loss of the line
- Maple River – Arrowhead 500 kV
- Dorsey – Riel 500 kV
- Arrowhead – Chisago - King 345 kV
- North La Crosse - W. Middleton – Rockdale 345 kV line
- This option may require series compensation on the Arrowhead – Gardner Park 345 kV line and additional shunt reactive support. Base assumptions will exclude such reactive compensation; and a scenario including these will be studied if required.
- Option assumes use of Helena - Lake Marion – North Rochester – North La Crosse 345 kV CAPX 2020 facilities

Option 2



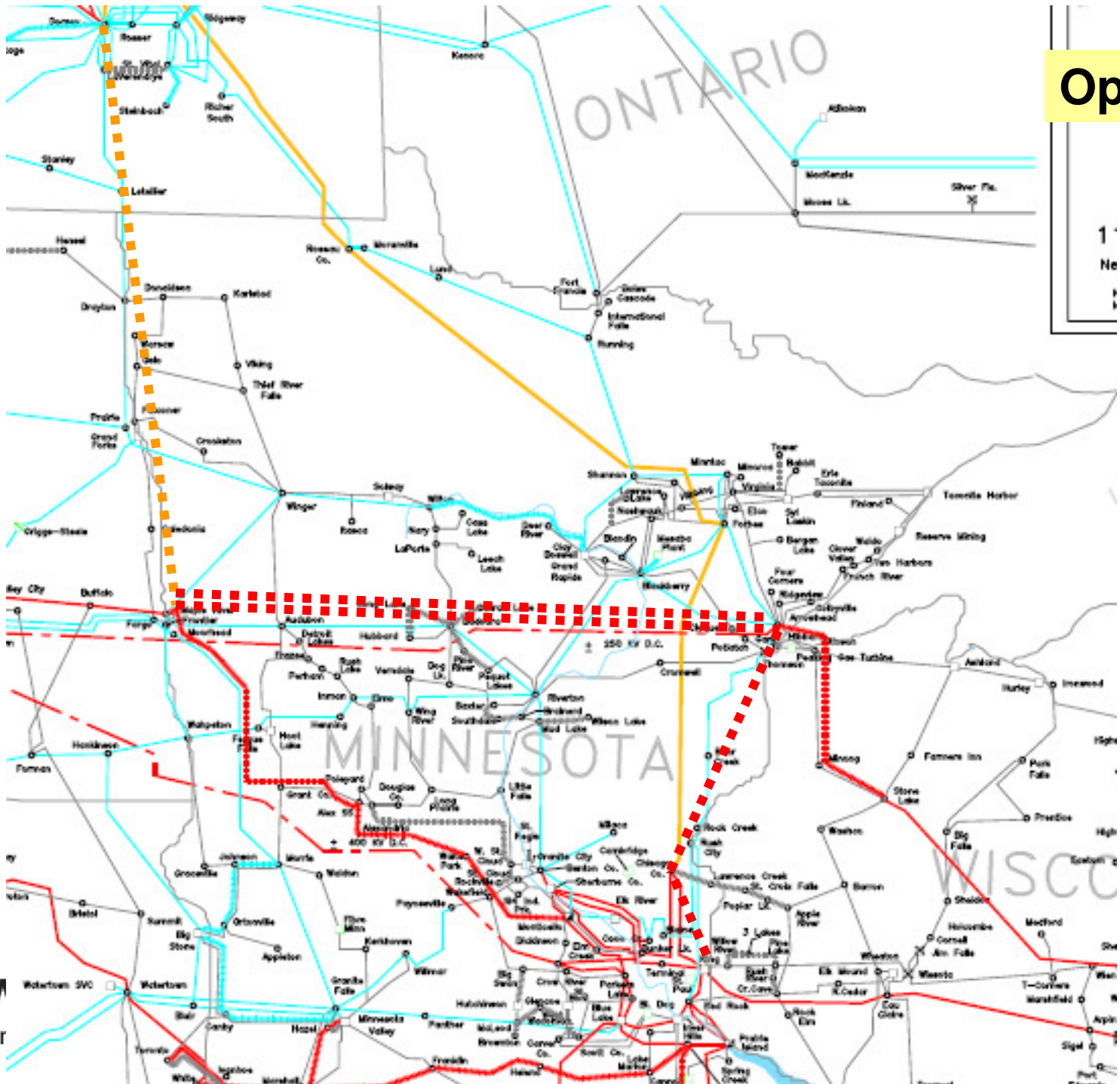
Midv
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Proposed Transmission Upgrades

Option 2a

- Dorsey – Maple River 500 kV
 - 500 kV single circuit, series compensated; series capacitors located at Prairie; HVDC reduction for the loss of the line
- Maple River – Arrowhead 345 kV double circuit
- Arrowhead – Chisago - King 345 kV
- Dorsey – Riel 500 kV
- North La Crosse - W. Middleton – Rockdale 345 kV line
- This option may require series compensation on the Arrowhead – Gardner Park 345 kV line and additional shunt reactive support. Base assumptions will exclude such reactive compensation; will be studied if required
- Option assumes use of Helena - Lake Marion – North Rochester – North La Crosse 345 kV CAPX 2020 facilities

Option 2a



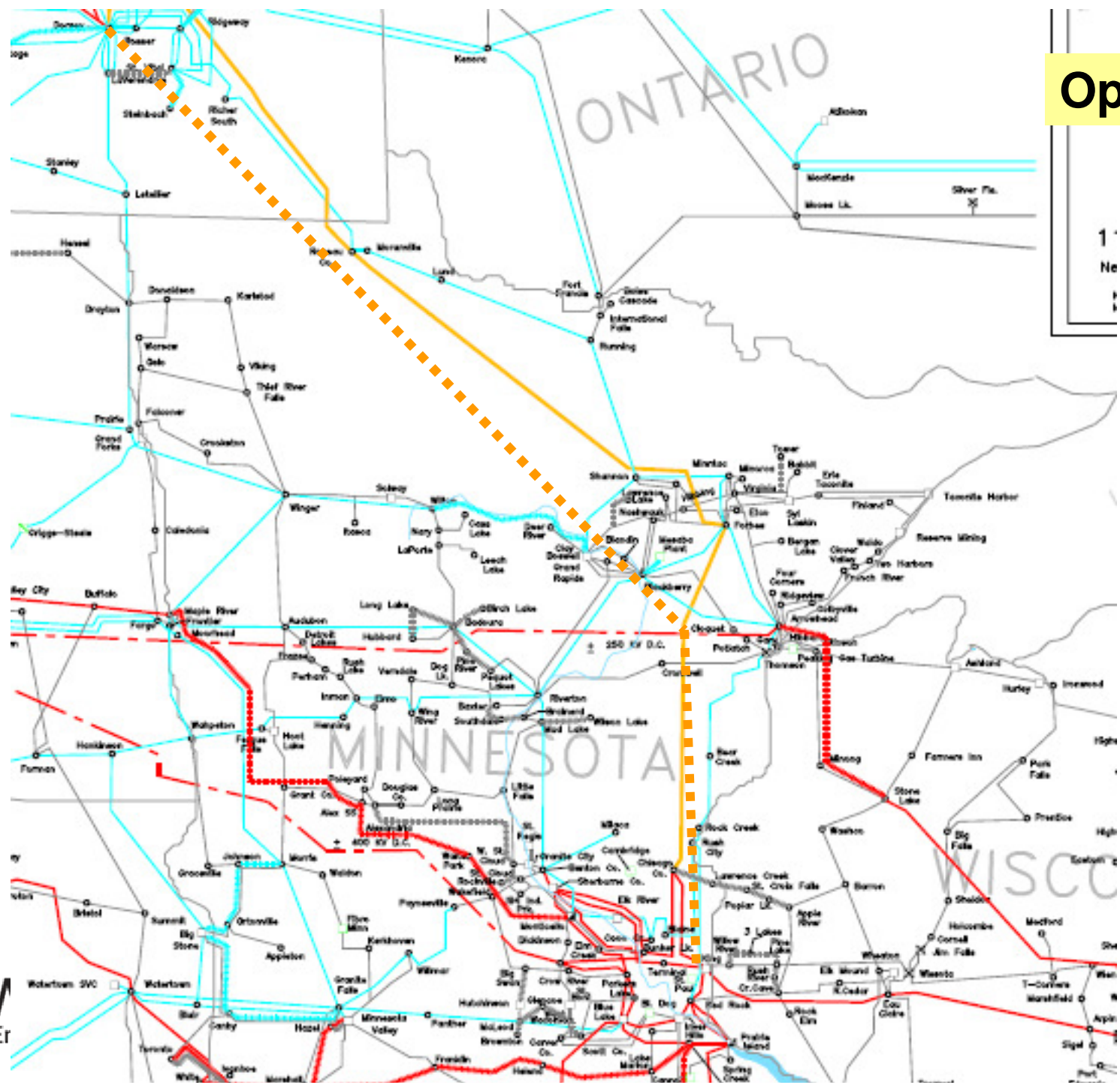
Midwest

Proposed Transmission Upgrades

Option 3

- Another 500 kV from Dorsey to King, parallel to the path of the existing 500 kV line
 - 500 kV single circuit, series compensated; HVDC reduction for the loss of the line
- North La Crosse - W. Middleton – Rockdale 345 kV line
- Dorsey – Riel 500 kV
- Option assumes use of Helena - Lake Marion – North Rochester – North La Crosse 345 kV CAPX 2020 facilities

Option 3



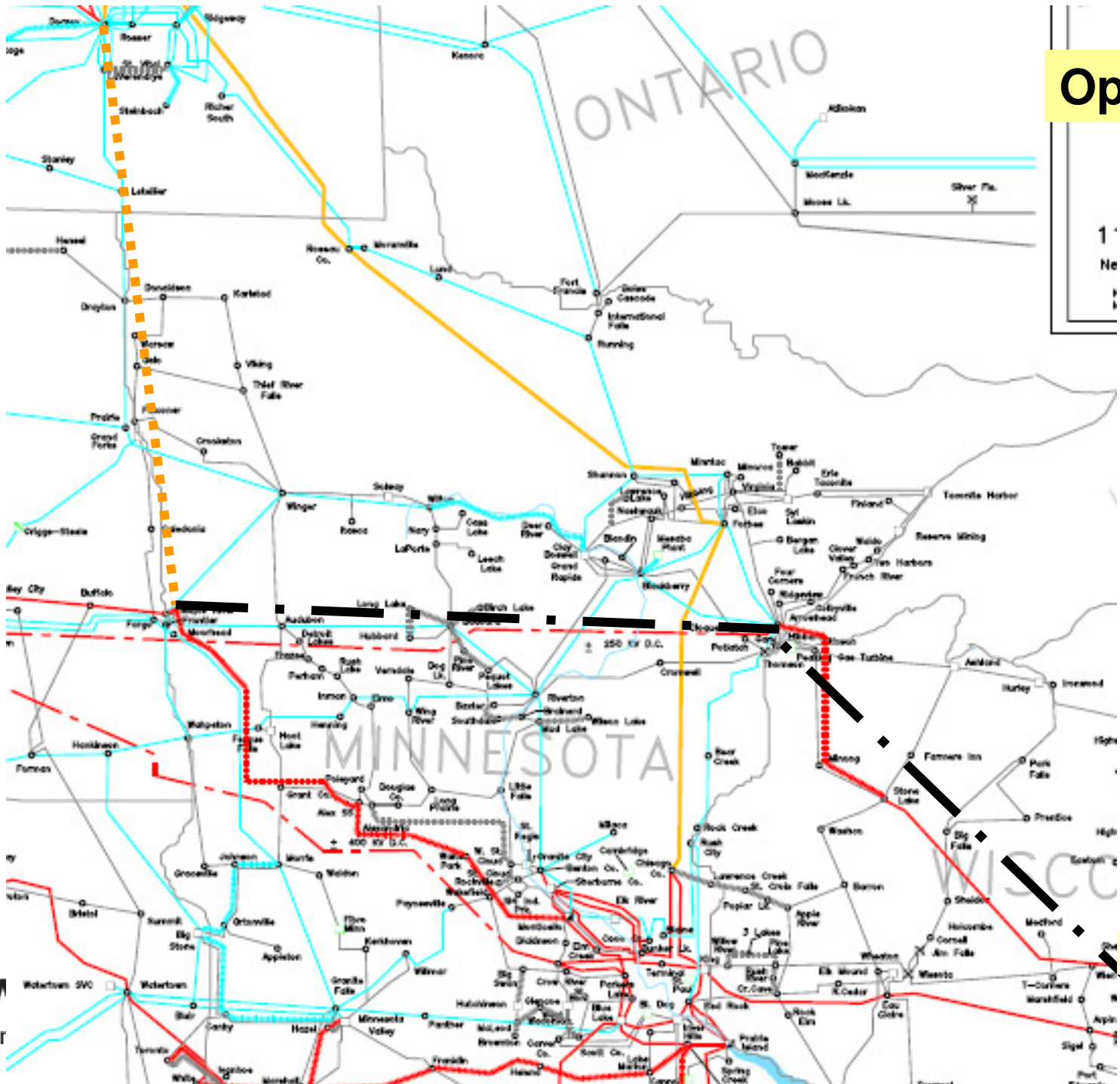
Midwestern

Proposed Transmission Upgrades

Option 4

- Option 4a
 - Dorsey – Maple River 500 kV AC
 - Maple River - Arrowhead – N. Appleton DC
 - N. Appleton to Morgan 345 kV AC
 - Dorsey – Riel 500 kV
- 500 kV AC single circuit, series compensated; series capacitors located at Prairie; HVDC reduction for the loss of the line
- Option assumes use of Helena - Lake Marion – North Rochester – North La Crosse 345 kV CAPX 2020 facilities

Option 4a



Midv
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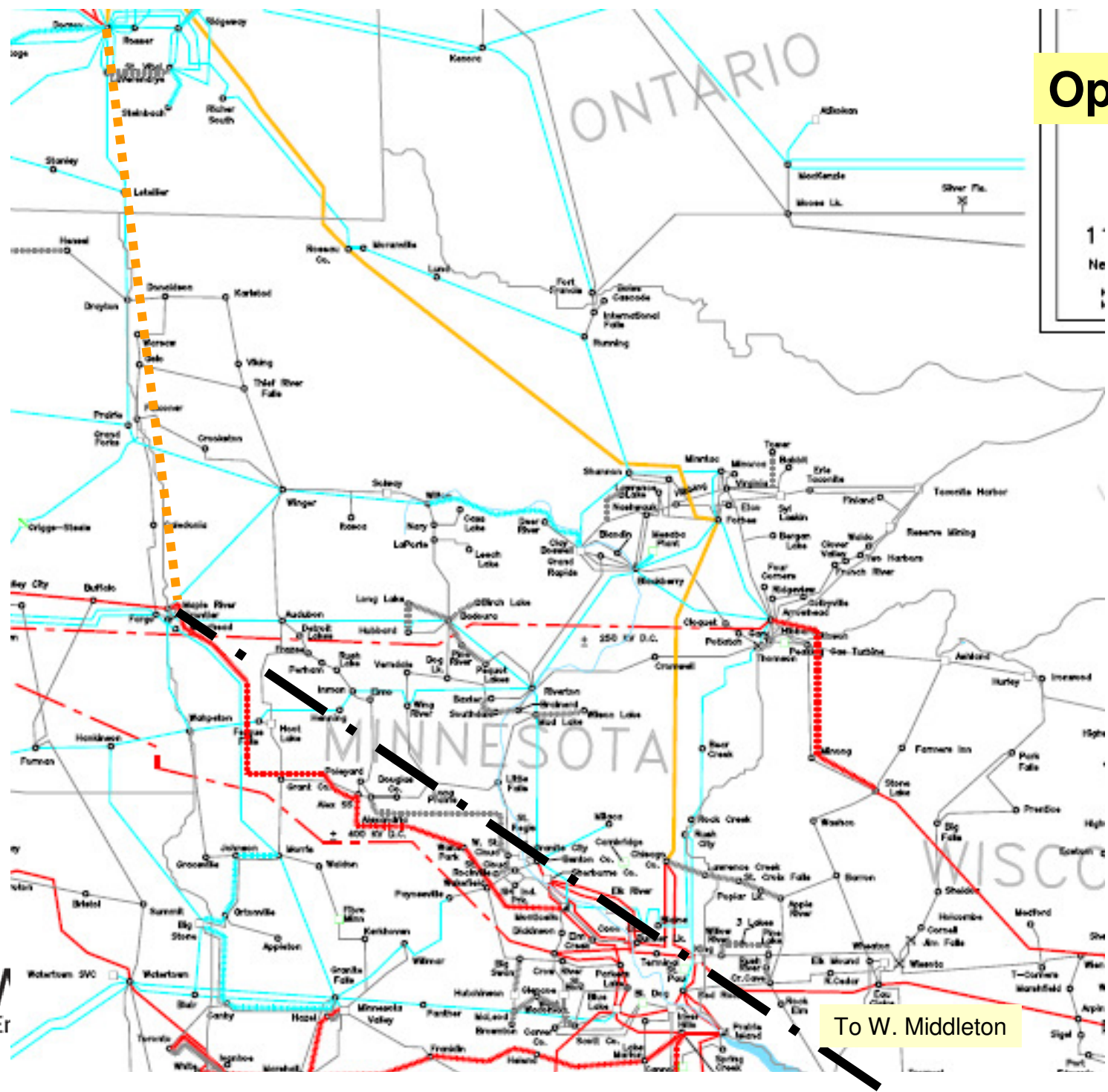
To N. Appleton

Proposed Transmission Upgrades

Option 4, contd...

- Option 4b
 - Dorsey – Maple River 500 kV AC
 - Maple River - W. Middleton DC
 - W. Middleton – N. Madison 345 kV AC
 - Dorsey – Riel 500 kV
- 500 kV AC single circuit, series compensated; series capacitors located at Prairie; HVDC reduction for the loss of the line
- Option assumes use of Helena - Lake Marion – North Rochester – North La Crosse 345 kV CAPX 2020 facilities

Option 4b



Midwest

To W. Middleton

List of TSRs – South Flow

A_REF	TS_TYPE	START TIME	STOP TIME	POR	POD	CAPACITY
76486855	POINT_TO_POINT	5/1/2007	5/1/2009	MHEB	CIN	80
76486858	POINT_TO_POINT	5/1/2007	5/1/2009	MHEB	NSP	80
76503369	NETWORK	4/1/2008	4/1/2013	MHEB	NSP	30
76612785	POINT_TO_POINT	11/1/2009	11/1/2014	MHEB	NSP	250
76492364	NETWORK	11/1/2014	11/1/2024	MHEB	GRE	200
76544681	NETWORK	6/1/2017	6/1/2037	MHEB	MP	250
76637045	NETWORK	6/1/2017	6/1/2027	MHEB	NSP	50
76637046	NETWORK	6/1/2017	6/1/2027	MHEB	WEC	100
76537306	NETWORK	6/1/2017	6/1/2027	MHEB	WPS	500

List of TSRs – North Flow

A_REF	TS_TYPE	START TIME	STOP TIME	POR	POD	CAPACITY	Study Number
76637091	POINT_TO_POINT	11/1/2014	11/1/2024	GRE	MHEB	100	A415
76637089	POINT_TO_POINT	11/1/2014	11/1/2024	GRE	MHEB	100	A415
76637257	POINT_TO_POINT	6/1/2017	6/1/2027	WEC	MHEB	50	A414
76637260	POINT_TO_POINT	6/1/2017	6/1/2027	ALTE	MHEB	50	A413
76637259	POINT_TO_POINT	6/1/2017	6/1/2027	ALTE	MHEB	50	A413
76544699	NETWORK	6/1/2017	6/1/2037	MP	MHEB	250	A383
76537582	NETWORK	6/1/2017	6/1/2027	WPS	MHEB	500	A380