Table ZS-2
2015 Limitations and Performance Criteria Exceeded

Planning Zone	Criteria Exceeded/Need	2015 Summer Peak Case		2015 70% Load Case		2015 90% Load Case		2015 105% Load Case		2015 High Wind		Facility Outage(s)	Project/Mitigation
		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
1	Base case loading criteria exceeded	TRUE	--	FALSE	--	FALSE	--	TRUE	--	FALSE	--	System Intact	
1	Base case voltage criteria exceeded	--	FALSE	--	FALSE	--	TRUE	--	FALSE	--	FALSE	System Intact	
1	Silver Lake, ACEC Spring Lake, Redgranite, Fountain Valley and River Run 69-kV buses	--	89.5 – 91.6% 91.3 – 91.7% -- --	--	--	--	--	--	88.2 – 91.5% 90.0 – 91.7% 91.1 – 91.9% 91.2 – 91.4%	--	--	Wautoma – Silver Lake Tap 69-kV line Silver Lake – ACEC Spring Lake 69-kV line ACEC Spring Lake – Redgranite 69-kV line Metomen – Ripon 69-kV line	Adjust Sunset Point 138/69-kV transformer LTCs
1	Dartford,Ripon Industrial Park, Northwest Ripon and Ripon 69-kV buses	--	89.0 – 89.7% 90.3 – 91.4%	--	--	--	--	--	87.9 – 89.5% 89.4 – 91.0% 91.2% 91.4% 92.0%	--	--	Metomen – Ripon 69-kV line Ripon – Northwest Ripon Tap 69-kV line Wautoma – Silver Lake Tap 69-kV line Northwest Ripon Tap – Dartford Tap 69-KV line Silver Lake – ACEC Spring Lake 69-KV line	Ripon Capacitor Expansion Project
1	Winneconne, Omro and Omro Industrial Park 69-kV buses	--	91.1 – 91.6%	--	--	--	--	--	90.0% – 90.6%	--	--	Winneconne – Sunset Point 69-kV line	Marginal voltage, no mitigation needed within this timeframe
1	ACEC Brooks and Grand Marsh (PP&L) 69-kV buses	--	--	--	--	--	--	--	91.9% – 92.0% 92.0%	--	--	Necedah Tap – Big Pond 69-kV line Petenwell – Big Pond 69-kV line	Marginal voltage, no mitigation needed within this timeframe
1	Petenwell and Council Creek 138-kV buses	--	95.7% 88.2 – 89.4% 88.2 – 89.4% 88.3 – 89.5% 90.6 – 90.7%	--	91.6% 91.6% 91.7%	--	89.6 – 90.8% 89.5 – 90.8% 89.6 – 90.8%	--	95.8 – 95.9% 87.7 – 88.9% 87.7 – 88.9% 87.8 – 89.0% 90.4 – 90.6%	--	--	System Intact ACEC Badger West – Petenwell 138-kV line Saratoga – Petenwell 138-kV line[1] ACEC Badger West – Saratoga 138-kV line Arpin – Rocky Run 345-kV line[2]	Adjust Council Creek 138/69-kV transformer LTC
1	Necedah, Petenwell, Big Pond, ACEC Dellwood, Friendship, Houghton Rock and McKenna 69-kV buses	--	84.9 – 91.1% 84.9 – 91.1% 85.2 – 91.3% 88.8 – 91.8%	--	90.8% – 91.6% 90.8% – 91.6% 90.7% – 91.6%	--	86.8% – 91.0% 86.8% – 91.0% 86.7% – 91.0% 89.9% – 91.7%	--	84.1 – 90.5% 84.0 – 90.5% 84.0 – 90.4% 88.2 – 91.2%	--	91.5% – 91.6% 91.5% – 91.6% 91.5% – 91.6%	Petenwell 138/69-kV transformer Petenwell – Big Pond 69-kV line Necedah Tap – Big Pond 69-kV line Necedah Tap – Whistling Wings Tap 69-kV line	McKenna Capacitor Expansion Project
1	Okee 69-kV bus	--	--	--	--	--	--	--	91.7%	--	--	Dane – Lodi Tap 69 kV line	Marginal voltage, no mitigation needed within this timeframe
1	ACEC Coloma 69-kV bus	--	--	--	--	--	--	--	91.6%	--	--	Chaffee Creek – Coloma Tap 69-kV line	Marginal voltage, no mitigation needed within this timeframe
1	Brooks Corner 69-kV bus	--	87.4%	--	89.5%	--	87.8%	--	87.5%	--	89.7%	Whitcomb – Deer Trail 69-kV line[3]	Adjust Brooks Corners 69/34.5-kV transformer LTC
1	Badger West 138-kV bus	--	88.3%	--	91.7%	--	89.6%	--	87.7%	--	--	ACEC Badger West – Saratoga 138-kV line	Adjust Council Creek 138/69-kV transformer LTC
1	Arrowhead 345-kV bus	--	--	--	--	--	105.0%	--	--	--	--	System Intact	Switch Arrowhead 230-kV capacitor bank offline
1	Petenwell 138/69-kV transformer	103.3% 111.4% 108.7% 107.0% 105.9% 104.8 – 98.2%	--	--	--	100.9%	--	105.5% 116.7% 111.1% 107.5% 107.6% 108.0 – 102.6%	--	--	--	System Intact McKenna – Houghton Rock 69-kV line Castle Rock – Quincy ACEC 69-kV line McKenna – Quincy ACEC 69-kV line Castle Rock – McKenna 69-kV line Plus other less severe contingencies	Replace Petenwell transformer
1	Castle Rock – ACEC Quincy 69-kV line	104.8% 104.7% 104.6%	--	--	--	--	--	107.9% 107.9% 107.9%	--	--	--	Petenwell 138/69-kV transformer Petenwell – Big Pond 69-kV line Necedah Tap – Big Pond 69-kV line	Uprate Castle Rock – McKenna 69-kV line

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Planning Zone	Criteria Exceeded/Need	2015 Summer Peak Case		2015 70% Load Case		2015 90% Load Case		2015 105% Load Case		2015 High Wind		Facility Outage(s)	Project/Mitigation
		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
1	ACEC Quincy – McKenna 69-kV line	98.3% 98.2% 98.2%	--	--	--	96.0% 96.0% 96.0%	--	101.1% 101.1% 101.1%	--	--	--	Petenwell 138/69-kV transformer Petenwell – Big Pond 69-kV line Necedah Tap – Big Pond 69-kV line	Uprate Castle Rock – McKenna 69-kV line
1	Mauston – Hilltop 69-kV line	--	--	--	--	--	--	--	--	99.3%	--	Arpin – Rocky Run 345-kV line[2]	Marginal issue, no mitigation needed within this timeframe
1	Saratoga – ACEC Badger West 138-kV line	--	--	--	--	--	--	96.9% 96.5% 96.4%	--	--	--	Eau Claire – Arpin 345 kV line[4] King – Arpin 345-kV line[22] King – Eau Claire 345 kV line[5]	Marginal issue, no mitigation needed within this timeframe
1	Caroline 115/69-kV transformer	95.9%	--	--	--	--	--	101.2%	--	--	--	Whitcomb 115/69-kV transformer	Marginal issue, no mitigation needed within this timeframe
1	Chaffee Creek – Coloma Tap 69-kV line	95.0%	--	--	--	--	--	100.7%	--	--	--	Petenwell 138/69-kV transformer	Marginal issue, no mitigation needed within this timeframe
1	Harrison 138/69-kV transformer	99.8%	--	--	--	--	--	102.7%	--	--	--	System Intact	Replace Harrison transformer
1	Metomen 138/69-kV transformer	96.3%	--	--	--	--	--	106.1% 104.6%	--	--	--	System Intact North Fond du Lac 138/69-kV transformer #3[6]	Adjust Metomen 138/69-kV transformer LTC
1	Northwest Ripon – Ripon 69-KV line	--	--	--	--	--	--	95.9%	--	--	--	Winneconne – Sunset Point 69-kV line	Marginal issue, no mitigation needed within this timeframe
1	Sigel – Auburndale 69-kV line	95.4%	--	--	--	--	--	101.1%	--	--	--	System Intact	Higher ratings -- validated
1	Vulcan – Port Edwards 138-kV line #2 Vulcan – Port Edwards 138-kV line #1	123.2% 123.0%	--	123.2% 123.0%	--	122.9% 122.9%	--	123.1% 122.9%	--	123.1% 122.9%	--	Port Edwards – Vulcan Chemical 138-kV #1 line Port Edwards – Vulcan Chemical 138-kV #2 line	Change tap on free standing CT's at Port Edwards
2	Base case loading criteria exceeded	TRUE	--	FALSE	--	FALSE	--	FALSE	--	FALSE	--	System Intact	
2	Base case voltage criteria exceeded	--	TRUE	--	TRUE	--	TRUE	--	TRUE	--	TRUE	System Intact	
2	M38-Atlantic 69-kV line	115.0% – 119.8%	--	--	--	-- -- 108.6%	--	122.2% 122.2% 122.4%	--	--	--	M38 – Atlantic 138-kV line Atlantic 138/69-kV transformer M38 – Atlantic 69-kV line[23]	Mitigated by generation adjustments or uprate line
2	Straits – McGulpin 138-kV line 9901 Straits – McGulpin 138-kV line 9903	--	--	--	--	97.7%	--	--	--	--	--	Straits – McGulpin 138-kV line 9903 Straits – McGulpin 138-kV line 9901	Targeted for mitigation by Eastern U.P. area reinforcements
2	Lakota Road 69-kV bus	--	--	--	--	--	118.1%	--	--	--	118.1%	Lakota Road – Conover 69-kV line	Resolved by transformer model adjustments
2	Brevort, Hiawatha and Lakehead 138-kV buses	--	--	--	--	--	90.8 – 91.0%	--	--	--	--	Straits 138/69-kV transformer	Targeted for mitigation by Eastern U.P. area reinforcements
2	Engadine, Newberry, Newberry Hospital, Roberts, LouPac, Newberry Village, Hulbert and Eckerman 69-kV buses	--	74.6 – 91.9%	--	--	--	84.8 – 90.4%	--	61.9 – 73.3% 80.9 – 86.9%	--	--	Hiawatha – Engadine 69-kV line Engadine – Newberry 69-kV line	Mitigated by generation adjustments
2	Brimley, Goetzville, Pickford, Raco, Magazine and Talentino 69-kV buses	--	--	--	--	--	--	--	79.0 – 89.9% 79.1 – 89.1%	--	--	Hiawatha – Engadine 69-kV line Engadine – Newberry 69-kV line	Mitigated by generation adjustments
2	North Bluff, Bay View, Mead, Gladstone, Masonville, Lakehead, West Side, Escanaba, Delta, Harris and Chandler 69-kV buses	--	89.6 – 91.8%	--	88.0 – 90.7%	--	--	--	87.5 – 89.8%	--	--	Chandler 138/69-kV transformer	Mitigated by generation adjustments
2	Hulbert, Eckerman, LouPac, Newberry Hospital, Newberry Village and Roberts 69-kV buses	--	--	--	--	--	--	--	87.7 – 91.8%	--	--	Newberry – Newberry Hospital 69-kV line	Targeted for mitigation by Eastern U.P. area reinforcements
2	LouPac, Newberry Village, Roberts 69-kV buses	--	--	--	--	--	--	--	89.7 – 90.1% 89.7 – 90.1%	--	--	Hiawatha – Roberts[24] 69-kV line Newberry Hospital – Roberts 69-kV line	Targeted for mitigation by Eastern U.P. area reinforcements
2	Ontonagon, Stone Container and Winona 138-kV buses	--	91.3 – 91.7%	--	--	--	--	--	--	--	--	M38 – Winona 138-kV line	Mitigated by generation adjustments

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		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
2	Straits, St. Ignace, Indian Lake, Evergreen, Valley, Glen Jenks, Manistique, Engadine, Hiawatha, Gould City and Curtis 69-kV buses	--	104.0 – 105.3%	--	105.1 – 105.8%	--	--	--	--	--	104.7 – 105.6%	System Intact	Adjust transformer tap settings at Hiawatha, Indian Lake, Straits
2	Nordic – Mountain 69-kV line	--	--	99.7 – 101.3%	--	--	--	100.9% --	--	--	--	Chandler 138/69-kV transformer Plains – Arnold 138-kV line	Mitigated by generation adjustments
2	Rudyard – Pine River 69-kV line Rudyard – Tone 69-kV line Kinchloe – Tone 69-kV line	--	--	--	--	--	--	100.0 – 100.1% 103.3 – 103.4% 97.2 – 97.3%	--	--	--	Hiawatha – Engadine 69-kV line Engadine – Newberry 69-kV line	Mitigated by generation adjustments
2	Hiawatha 138-kV bus	--	--	--	--	--	94.5%	--	--	--	--	System Intact	Targeted for mitigation by Eastern U.P. area reinforcements
2	Straits 69-kV bus	--	--	--	--			--	105.1%	--	--	System Intact	Targeted for mitigation by Eastern U.P. area reinforcements
2	Pine River – Straits 69-kV line Pine River – Evergreen 69-kV line Straits – Evergreen 69-kV line	--	--	--	--	101.4 – 105.2% 101.0 – 104.8% 106.5 -110.5%	--	--	--	--	--	Hiawatha – Straits[25] 138-kV line Straits 138/69-kV transformer	Targeted for mitigation by Eastern U.P. area reinforcements
3	Base case loading criteria exceeded	FALSE	--	FALSE	--	FALSE	--	FALSE	--	FALSE	--	System Intact	
3	Base case voltage criteria exceeded	--	FALSE	--	FALSE	--	FALSE	--	FALSE	--	FALSE	System Intact	
3	Dane – Lodi Tap 69-kV line	--	--	--	--	--	--	98.6%	--	--	--	Island Street – Kirkwood 69-KV line	Marginal issue, no mitigation needed within this timeframe
3	Lake Geneva, Katzenberg, Twin Lakes, and South Lake Geneva 69-kV buses	--	88.6 – 90.2%	--	--	--	--	--	--	--	--	North Lake Geneva – Lake Geneva 69-kV line	North Lake Geneva – South Lake Geneva 138-kV line
3	Cobblestone 69-kV bus	--	91.4%	--	--	--	--	--	91.2%	--	--	Cobblestone – Brick Church 69-kV line	North Lake Geneva – South Lake Geneva 138-kv line
3	Concord, Brick Church, Williams Bay and Fort Atkinson 138-kV buses+B73	--	--	--	95.6 – 95.9%	--	95.9%	--	--	--	--	System Intact	Marginal voltage, no mitigation needed within this timeframe
3	Lake Geneva 69-kV bus	--	--	--	--	--	91.8%	--	86.6%	--	--	North Lake Geneva – Lake Geneva 69-kV line	North Lake Geneva – South Lake Geneva 138-kv line
3	Beloit Gateway 138-kV bus	--	--	--	--	--	91.6%	--	--	--	--	Beloit Gateway – Dickinson 138-kV line	Marginal voltage, no mitigation needed within this timeframe
3	Katzenberg, Twin Lakes, and South Lake Geneva 69-kV buses	--	--	--	--	--	--	--	87.6 – 88.3%	--	--	North Lake Geneva – Lake Geneva 69-kV line	North Lake Geneva – South Lake Geneva 138-kV line
3	Concord 138-kV bus	--	--	--	95.9% --	--	95.4% 91.7%	--	--	--	--	System Intact Jefferson – Crawfish River 138-kV line	Marginal voltage, no mitigation needed within this timeframe
3	Brick Church 138-kV bus	--	--	--	95.6% --	--	95.6% 91.9%	--	--	--	--	System Intact Beloit Gateway – Dickinson 138-kV line	Marginal voltage, no mitigation needed within this timeframe
3	Crawfish River 138-kV bus	--	--	--	--	--	90.7%	--	--	--	--	Jefferson – Crawfish River 138-kV line	Marginal voltage, no mitigation needed within this timeframe
3	Butler Ridge 138-kV bus	--	--	--	--	--	95.9% 91.8%	--	--	--	--	System Intact Hartford – St. Lawrence 138-kV line	Marginal voltage, no mitigation needed within this timeframe
3	Williams Bay, Bristol, Delavan, SW Delavan, Brick Church and Elkhorn 138-kV buses	--	--		91.3 – 91.9%	--	--	--	--	--	--	Wempletown – Paddock 345-kV line	Marginal voltage, no mitigation needed within this timeframe

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		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
3	Beloit Gateway, BOC Gas, NW Beloit, RC9, Williams Bay, Bristol, Delavan, West Darien, RC2, Sunrise, Venture, Tichigan, EL&W, Sugar Creek, Burlington, Whitewater, SW Delavan, Rock River, Blackhawk, Paddock, Colley Road, Dickinson, Marine, Brick Church, North Lake Geneva, Elkhorn, Janesville, Russell, McCue, Viking, Townline, Wilcox, Kennedy, Tripp, Air Liquide, University, Bluff Creek, Lakehead-Delavan 138-kV buses	--	--	--	87.8 – 91.8%	--	--	--	--	--	--	Paddock 345/138-kV transformer	Further study needed
3	Beloit Gateway, BOC Gas, NW Beloit, RC9, Williams Bay, Bristol, Delavan, West Darien, RC2, Venture, SW Delavan, Rock River, Blackhawk, Paddock, Colley Road, Dickinson, Marine, Brick Church, Townline 138-kV buses	--	--	--	--	--	--	--	--	--	90.9 – 91.9%	Paddock 345/138-kV transformer	Marginal voltage, no mitigation needed within this timeframe
3	Cobblestone – Zenda Tap 69-kV line	105.0%	--	--	--	--	--	112.7%	--	--	--	North Lake Geneva – Lake Geneva 69-kV line	North Lake Geneva – South Lake Geneva 138-kV line
3	Colley Road 138/69-kV transformer	96.9%	--	--	--	--	--	100.2%	--	--	--	Paddock 138/69-kV transformer	Marginal issue, no mitigation needed within this timeframe
3	Katzenberg – Zenda Tap 69-kV line	95.3%	--	--	--	--	--	102.2%	--	--	--	North Lake Geneva – Lake Geneva 69-kV line	North Lake Geneva – South Lake Geneva 138-kV line
3	Paddock – Townline 138-kV line	--	--	102.4% 100.9% 99.9%	--	--	--	--	--	--	--	NW Beloit – Paddock 138-kV line Blackhawk – NW Beloit – Paddock 138-kV line Blackhawk – NW Beloit 138-kv	Mitigated by generation adjustments
3	NW Beloit – Paddock 138-kV line	--	--	97.6%	--	--	--	--	--	--	--	Paddock – Townline 138-kV line	Marginal issue, no mitigation needed within this timeframe
3	Lake Geneva – South Lake Geneva 69-kV line	--	--	--	--	--	--	97.7%	--	--	--	Cobblestone – Brick Church 69-kV line	Marginal issue, no mitigation needed within this timeframe
3	North Monroe – Idle Hour 69-kV line	103.9 – 96.1%	--	--	--	95.4% -- -- -- -- --	--	109.1 – 96.2%	--	--	--	Paddock – Newark 69-kV line Paddock – Brodhead Switching Station 69-kV line[7] Brodhead – Newark 69-kV line Darlington – Gratiot 69-kV line Wiota – Gratiot 69-kV line Darlington 138/69-kV transformer	Bass Creek transformer project
3	McCue – REC Harmony – Milton Tap – Lamar 69-kV line	103.3 – 95.4%	--	--	--	--	--	109.1 – 97.7%	--	--	--	Kegonsa – Stoughton North Tap2 69-kV line Kegonsa 138/69-kV transformer Stoughton North Tap1 – Stoughton North Tap2 69-kV line Stoughton East – Stoughton North 69-kV line	McCue to Lamar line uprate project
3	Sheepskin – Dana 69-kV line	--	--	--	--	--	--	99.9%	--	--	--	McCue – Lamar 69-kV line	Sheepskin terminal upgrade
3	Boscobel – Wauzeka – Gran Grae 69-kV line	--	--	--	--	--	--	98.0 – 96.4%	--	--	--	Spring Green 138/69-kV transformer Spring Green – Lone Rock 69-kV line	Gran Grae line uprate project
3	Wauzeka – Gran Grae 69-kV line	95.3%	--	--	--	--	--	--	--	--	--	Spring Green 138/69-kV transformer	Gran Grae line uprate project
3	Timberlane Tap – West Middleton 69-kV line	101.4%	--	--	--	96.9%	--	108.0%	--	--	--	Spring Green 138/69-kV transformer	West Middleton to Stagecoach line uprate
3	Royster – AGA Gas Tap – Pflaum 69-kV line	111.8 – 95.2%	--	--	--	--	--	117.8 – 99.1%	--	--	--	Fitchburg – Syene 69-kV line Nine Springs – Syene 69-kV line Fitchburg – Nine Springs 69-kV line[8]	Nine Springs, Pflaum area project
3	Royster – AGA Gas Tap	--	--	--	--	101.5%	--	--	--	--	--	Fitchburg – Syene 69-kV line	Nine Springs, Pflaum area project
3	Fitchburg – Syene – Nine Springs 69-kV line	113.4 – 97.3%	--	--	--	--	--	119.3 – 102.4%	--	--	--	Royster – AGA tap 69-kV line Pflaum – AGA tap 69-kV line Royster – AGA tap 69-kV line[9]	Nine Springs, Pflaum area project
3	Fitchburg – Syene 69-kV line	--	--	--	--	102.8%	--	--	--	--	--	Royster – AGA tap 69-kV line	Nine Springs, Pflaum area project

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		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
3	Verona 138-kV bus	--	95.4% 87.2%	--	-- 90.05%	--	-- 88.4%	--	95.1% 86.5%	--	-- 91.4%	System Intact Verona – Oak Ridge 138-kV line	Adjust Verona 138/69-kV transformer LTC / Verona 69-kV capacitor bank project
3	Fitchburg 138-kV bus	--	95.9%	--	--	--	--	--	--	--	--	System Intact	Verona 69-kV capacitor bank project
3	Fitchburg and Oak Ridge 138-kV buses	--	--	--	--	--	--	--	95.8 – 95.9%	--	--	System Intact	Verona 69-kV capacitor bank project
3	Southwest Verona 69-kV bus	--	89.6%	--	--	--	91.2%	--	88.5%	--	--	Verona – Southwest Verona 69-kV line	Further study needed
3	Huiskamp 138-kV bus	--	88.9%	--	88.2%	--	87.7%	--	87.8%	--	--	Huiskamp – North Madison 138-kV line	Adjust Huiskamp 138/69-kV transformer LTC
3	Brodhead Muni2, Brodhead Muni3, Brodhead and Brodhead Muni1 69-kV buses	--	91.6 – 91.8%	--	--	--	--	--	--	--	--	Brodhead Switching Station – Brodhead Muni3 69-kV line	Bass Creek transformer project
3	Brodhead Muni2, Brodhead Muni3, Brodhead, Brodhead Muni1, REC Orfordville, Orfordville, Bass Creek and Footville 69-kV buses	--	--	--	--	--	--	--	90.1 – 91.7%	--	--	Brodhead Switching Station – Brodhead Muni3 69-kV line Brodhead Muni 2 – Brodhead Muni3 69-kV line	Bass Creek transformer project
3	REC Harmony, Milton, Milton Tap, Lamar, Fulton and Saunders Creek 69-kV buses	--	88.5 – 91.9%	--	--	--	--	--	86.5 – 91.9%	--	--	McCue – Harmony 69-kV line Milton Tap – Harmony 69-kV line McCue – Lamar 69-kV line[10]	Lamar 69-kV capacitor bank project
3	AGA Gas 69-kV bus	--	--	--	--	--	--	--	92.0%	--	--	Royster – AGA tap 69-kV line	Nine Springs, Pflaum area project
3	McFarland, Femrite and Sprecher 138-kV buses	--	--	--	--	--	--	--	91.2 – 91.5%	--	--	Kegonsa – McFarland 138-kV line Femrite – McFarland 138-kV line Kegonsa – Femrite 138-kV line[11]	Dane County Corrective Plan
3	REC Harmony, Milton, Milton Tap, Lamar, Fulton 69-kV buses	--	--	--	--	--	91.3 – 91.9%	--	--	--	--	McCue – Harmony 69-kV line	Lamar capacitor bank
3	Hubbard and Hustisford 138-kV buses	--	-- 86.2% 86.8% 86.8% --	--	--	--	96.0% 86.8% 87.3% 87.3% 91.8%	--	-- 85.8% 86.5% 86.5% --	--	-- -- 87.4% 87.4% --	System Intact Rubicon – Hustisford 138-kV line Hustisford – Hubbard 138-kV line Rubicon – Hustisford – Hubbard 138-kV line Hartford – Saint Lawrence 138-kV line	Adjust Hubbard 138/69-kV transformer LTC
3	Fox Lake, North Beaver Dam and Beaver Dam East 138-kV buses	--	88.2 – 88.3% 88.9% 88.9%	--	--	--	89.4 – 89.5% -- --	--	87.4 – 87.5% 88.2 – 88.3% 88.2 – 88.3%	--	--	North Randolph – Fox Lake 138-kV line Fox Lake – North Beaver Dam 138-kV line North Randolph – North Beaver Dam 138-kV line[12]	Adjust North Beaver Dam 138/69-kV transformer LTC
3	Nelson Dewey – DPC Cassville 161-kV line	--	--	98.2 – 95.2%	--	--	--	--	--	--	--	Paddock 345/138-kV transformer DPC Genoa generator #3 Columbia generator #1 Columbia generator #2	Mitigation by potential generation adjustments / Futher study needed
3	Nelson Dewey – DPC Cassville 161-kV line	--	--	--	--	--	--	--	--	111.2 – 109.2%	--	DPC Seneca – DPC Genoa 161-kV line Genoa 161/69-kV transformer[13]	DPC line limitation / further study needed
3	Darlington – North Monroe 138-kV line	--	--	--	--	--	--	--	--	109.3 – 95.2%	--	Paddock 345/138-kV transformer Darlington 138/69-kV transformer	Mitigation by potential generation adjustments / Futher study needed
3	Nelson Dewey 161/138-kV transformer	--	--	--	--	--	--	--	--	100.5 – 95.5%	--	ComEd Byron generator #1 ComEd Braidwood generator #1 ComEd Braidwood generator #2 Point Beach generator #1 Point Beach generator #2 Kewaunee generator #1	Mitigation by potential generation adjustments / Futher study needed
3	West Middleton – Black Hawk 69-kV line	--	--	98.5 – 96.3%	--	--	--	--	--			North Madison – Vienna 138-kV line Vienna – Yahara River 138-kV line North Madison – Yahara River 138-kV line[14]	Mitigated by generation adjustments/ Potential Cardinal – Blount 138-kV line
3	Verona, Oak Ridge, and Fitchburg 138-kV buses	--	--	--	95.5 – 95.7%	--	--	--	--	--	--	System Intact	Femrite and Kegonsa 138-kV capacitor banks
4	Base case loading criteria exceeded	FALSE	--	FALSE	--	FALSE	--	FALSE	--	FALSE	--	System Intact	
4	Base case voltage criteria exceeded	--	FALSE	--	FALSE	--	FALSE	--	FALSE	--	FALSE	System Intact	
4	Non Converged Solution	--	--	Applies	--	--	--	--	--	Applies	--	Morgan – Plains 345-kV line[15] Morgan – Plains 345-kV line	Mitigated by generation adjustments
4	Morgan – Falls 138-kV line	--	--	103.4% 103.4%	--	--	--	--	--	96.0% 95.9%	--	Morgan – Plains 345-kV line[15] Morgan – Plains 345-kV line	Mitigated by generation adjustments

Table ZS-2
2015 Limitations and Performance Criteria Exceeded

Planning Zone	Criteria Exceeded/Need	2015 Summer Peak Case		2015 70% Load Case		2015 90% Load Case		2015 105% Load Case		2015 High Wind		Facility Outage(s)	Project/Mitigation
		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
4	East Krok 138/69-kV transformer	105.1% -- --	--	99.8% -- --	--	102.7% -- --	--	107.1% 96.5% 95.7%	--	--	--	Canal – East Krok 138-kV line Highway V 138/69-kV transformer #2[16] Highway V – East Krok 138-kV line	No project needed; Investigation into limiting facility resulted in higher facility ratings
4	Sunset Point – Pearl Avenue 69-kV line	116.3% 115.7%	--	--	--	104.6% 103.7%	--	122.6% 121.4%	--	--	--	Ellinwood 138/69-kV transformer[17] Ellinwood – 12th Avenue 69-kV line	Rebuild line
4	Highway V – Ontario 138-kV line	99% --	--	--	--	--	--	103.5% 98.7%	--	--	--	East Krok 138/69-kV transformer[18] Canal 138/69-kV transformer #1[19]	Uprate line
4	Dyckesville – Rosiere 69-kV line	95.0%	--		--	--	--	99.2%	--	--	--	East Krok 138/69-kV transformer[18]	Further study needed
4	White Clay 138-kV 1-2 bus tie	--	--	99.7%	--	--	--	--	--	--	--	Morgan – Highway 22 345-kV line	Further study needed
4	Highway V – Preble 138-kV line	--	--	97.5%	--	--	--	--	--	--	--	Morgan – Highway 22 345-kV line	Further study needed
4	Canal – East Krok 138-kV line	--	--	--	--	--	--	98.0%	--	--	--	Highway V 138/69-kV transformer #1[20]	Further study needed
4	Edgewater – Sauk Trail 138-kV line	--	--	--	--	--	--	96.8%	--	--	--	Edgewater – Huebner 138-kV line	Further study needed
4	East Krok – Kewaunee 138-kV line	--	--	--	--	96.0%	--	--	--	--	--	North Appleton 345/138 kV xfmr #1[21]	Further study needed
4	Manrap – Custer 69-kV line	--	--	--	--	--	--	97.2%	--	--	--	Dewey – Lakefront 69-kV line	Further study needed
5	Base Case Loading Criteria Exceeded	FALSE		FALSE		FALSE		FALSE		FALSE			
5	Base Case Voltage Criteria Exceeded		TRUE		FALSE		TRUE		TRUE		FALSE		
5	Bluemound 230-kV bus, Allerton, Brookdale, Cottonwood, Edgewood, and 28th St 138-kV buses	--	94.6 – 95.9%	--	--	--	--	--	--	--	--	System Intact	Shift Allerton load from T9 to T8
5	Bluemound 230-kV bus, Allerton, Brookdale, Cottonwood, and 28th St 138-kV buses	--	--	--	--	--	--	--	94.6 – 95.8%	--	--	System Intact	Shift Allerton load from T9 to T9
5	Burlington and Tichigan 138-kV buses	--	--	--	90.8 – 91.0%	--	--	--	--	--	--	Split Burlington 138-kV bus	Marginal voltage, no mitigation needed within this timeframe
5	Bark River 138-kV bus	--	--	--	--	--	95.6% 91.3%	--	--	--	--	System Intact Bark River – Sussex 138-kV line	Marginal voltage, no mitigation needed within this timeframe
5	Cottonwood 138-kV bus	--	--	--	--	--	95.3% 91.6%	--	--	--	--	System Intact Bark River – Sussex 138-kV line	Marginal voltage, no mitigation needed within this timeframe
5	Germantown 138-kV bus	--	--	--	-- -- -- 91.9%	--	94.6% 91.9% 91.5% 87.6%	--	--	--	--	System Intact Germantown – Maple 138-kV line Bark River – Sussex 138-kV line Maple – Saukville 138-kV line	Mitigated by generation adjustments
5	Hartford 138-kV bus	--	--	--	--	--	95.8% 91.4%	--	--	--	--	System Intact Hartford – St. Lawrence 138-kV line	Marginal voltage, no mitigation needed within this timeframe
5	Maple 138-kV bus	--	--	--	-- 91.7%	--	94.8% 87.3%	--	--	--	--	System Intact Maple – Saukville 138-kV line	Mitigated by generation adjustments
5	Summit, Cooney and Mukwonago 138-kV buses	--	--	--	--	--	95.5 – 95.8%	--	--	--	--	System Intact	Marginal voltage, no mitigation needed within this timeframe
5	Bain 345/138-kV transformer #5	159.7% 117.9%	--	147.3% --	--	159.3% --	--	159.2% 108.2%	--	147.5% 107.6%	--	Split Pleasant Prairie 345-kV bus 34 Split Pleasant Prairie 345-kV bus 23	Mitigated by generation adjustments
5	Oak Creek 345/230-kV transformer T895	105.0% 105.3%	--	95.3% --	--	104.7% --	--	104.9% 104.5%	--	95.1% --	--	Split Oak Creek 230-kV bus 78 Split Oak Creek 230-kV bus 67	Mitigated by generation adjustments
5	Arcadian4 – Waukesha1 138-kV line	104.8%	--	119.6%	--	134.2%	--	105.2%	--	--	--	Arcadian6 – Waukesha3 138-kV line	Rebuild line
5	Arcadian6 – Waukesha3 138-kV line	101.1% --	--	115.6% 103.5%	--	129.7% 113.6%	--	101.5% --	--	--	--	Arcadian4 – Waukesha1 138-kV line Split Waukesha 138-kV bus 12	Rebuild line
5	Arcadian 345/138-kV transformer #3	-- -- 99.8%	--	101.7% 99.7% 98.3%	--	105.6% 105.2% 110.9%	--	-- -- 101.8%	--	--	--	Split Arcadian 345-kV bus 12 Arcadian 345-kV bus outage Arcadian 345/138-kV transformer #1	Replace transformer
5	Arcadian 345/138-kV transformer #2	--	--	95.7% --	--	97.4% 102.4%	--	--	--	--	--	Split Arcadian 345-kV bus 12 Arcadian 345/138-kV transformer #2	Replace transformer
5	Bain – Kenosha 138-kV line	97.9%	--	--	--	--	--	--	--	--	--	Pleasant Prairie – Zion 345-kV line	Uprate Bain – Kenosha
5	Pleasant Prairie – Zion 345-kV line	95.7% -- -- -- --	--	--	--	--	--	98.1% 96.2% 100.2% 98.5% 95.4%	--	--	--	Zion – Arcadian 345-kV line Cherry Valley – Silver Lake 345-kV line Braidwood generator #1 or #2 Dresden generator #2 or #3 Zion Energy Ctr #1 or #2	Marginal issue, no mitigation needed within this timeframe
5	Granville 345/138-kV transformer #1	--	--	95.0%	--	107.2%	--	--	--	--	--	Split Granville 345-kV bus 23	Mitigated by generation adjustments

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Planning Zone	Criteria Exceeded/Need	2015 Summer Peak Case		2015 70% Load Case		2015 90% Load Case		2015 105% Load Case		2015 High Wind		Facility Outage(s)	Project/Mitigation
		% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage	% of Facility Rating	% of Nominal Bus Voltage		
5	Harbor – Kansas 138-kV line	--	--	109.5% 106.7% 106.6% 105.7% 99.6 – 102.5%	--	--	--	--	--	--	--	Kansas – Norwich 138-kV line Dewey – Norwich 138-kV line Split Dewey 138-kV bus Dewey – Montana 138-kV line Plus Other Less Severe Outages	Mitigated by generation adjustments
5	Albers – Kenosha 138-kV line	--	--	120.3%	--	103.3%	--	100.9%	--	--	--	Albers – Bain 138-kV line	Mitigated by generation adjustments
5	Edgewood – St. Martins 138-kV line	--	--	102.1% 98.8% 97.4% 96.5%	--	--	--	--	--	--	--	Merrill Hills – Waukesha 138-kV line Paris – Air Liquide 138-kV line Paris – Air Liquide – Burlington 138-kV line Burlington – Air Liquide 138-kV line	Mitigated by generation adjustments
5	Oak Creek – Ramsey 138-kV line	--	--	--	--	95.6%	--	--	--	--	--	Oak Creek – Pennsylvania 138-kV line	Marginal issue, no mitigation needed within this timeframe
5	Wauesha 138-kV bus 12	--	--	--	--	100.1%	--	--	--	--	--	Arcadian6 – Waukesha3 138-kV line	Mitigated by generation adjustments
5	Kenosha – Lakeview 138-kV line	--	--	--	--	--	--	100.7%	--	--	--	Pleasant Prairie – Zion 345-kV line	Rebuild line
5	Lakeview – Zion 138-kV line	--	--	--	--	--	--	96.7%	--	--	--	Pleasant Prairie – Zion 345-kV line	Further study needed

Event Based Contingency	Definition of Event Based Contingency
1	Saratoga – ACEC Badger West – Petenwell138-kV line
2	Arpin – Rocky Run 345-kV line + Port Edwards – Sand Lake 138-kV line + Port Edwards – Hollywood 138-kV line + Council Creek – Council Creek DPC 69-kV line
3	Whitcomb – CWEC Wittenberg Tap – Wittenberg Tap – Birnamwood Tap – Brooks Corner – Deer Trail 69-kV line
4	Eau Clare – Arpin 345-kV line + Council Creek DPC – Council Creek 69-kV line + Hilltop – Mauston 69-kV line
5	King – Eau Claire 345-kV line + Eau Clare – Arpin 345-kV line + Eau Clare 345/161-kV transformer + Council Creek DPC – Council Creek 69-kV line + Hilltop – Mauston 69-kV line + Lubin – Lakehead 69-kV line
6	North Fond du Lac 138/69-kV transformer #3 + North Fond du Lac – Hickory Street Tap 69-kV line + North Fond du Lac – Rosendale 69-kV line + North Fond du Lac 69-kV bus capacitor
7	Paddock – REC Newark – Brodhead Switching Station 69-kV line
8	Fitchburg – Syene – Nine Springs 69-kV line
9	Royster – AGA tap – LCI 69-kV line
10	McCue – Harmony – Milton Tap – Lamar 69-kV line
11	Kegonsa – McFarland – Femrite 138-kV line
12	North Randolph – Fox Lake – North Beaver Dam 138-kV line
13	Genoa 161/69-kV transformer + Genoa-Seneca 161-kV line + Genoa-Lansing W 161-kV line+ Genoa-Lac Tap 161-kV line
14	North Madison-Vienna-Yahara River 138-kV line
15	Morgan – Plains 345-kV line + Morgan 24.9 kV reactor + Plains 24.9 kV reactor
16	Highway V 138/69 kV xfmr #2 + Highway V - East Krok 138 kV circuit + Highway V - Mystery Hills 138 kV circuit + Highway V - Oak Street 69 kV circuit
17	Ellinwood 138/69 kV xfmr #1 + Ellinwood - Twelfth Ave 69 kV circuit + Ellinwood - Fitzgerald 138 kV circuit +Ellinwood 138 kV bus tie 1-2
18	East Krok 138/69 kV xfmr + Highway V - East Krok 138 kV circuit + East Krok - Canal 138 kV circuit + East Krok - Kewaunee 138 kV circuit + Beardsely - East Krok 69 kV circuit
19	Canal 138/69 kV xfmr #1 + Canal - East Krok 138 kV circuit + Canal - Sawyer 69 kV circuit + Canal - Algoma 69 kV circuit + Canal 69 kV cap banks, 2 x 16.3 MVAr
20	Highway V 138/69 kV xfmr #1 + Highway V - Ontario 138 kV circuit + Highway V - Preble 138 kV circuit + Highway V - Finger Road 69 kV circuit + Highway V - Rockland 138 kV circuit + Highway V 138 kV cap bank, 2 x 18.9 MVAr
21	North Appleton 345/138 kV xfmr #1 + North Appleton - Kewaunee 345 kV circuit
22	King – Eau Clare 345-kV line + Eau Clare – Arpin 345-kV line + Eau Clare 345/161-kV transformer + Council Creek DPC – Council Creek 69-kV line + Hilltop – Mauston 69-kV line
23	M38-Atlantic 69-kV line + Atlantic 138/69-kV transformer
24	Hiawatha-Engadine-Newberry-Newberry Hospital-Roberts 69-kV line
25	Hiawatha-Lakehead-Brevort-Straits 138-kV line