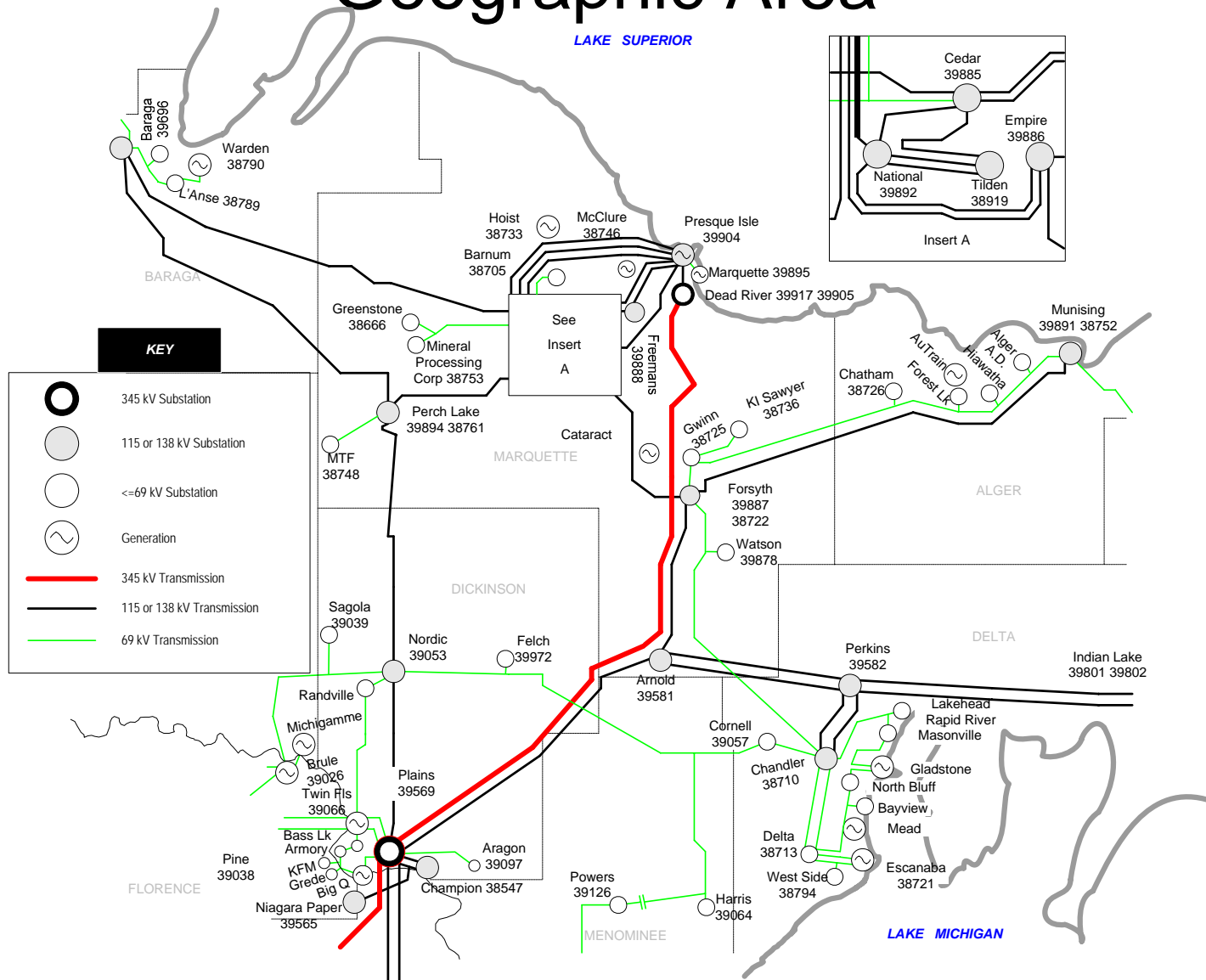


Presque Isle Remedial Action Tripping Scheme Year 2007 System Conditions

March 21, 2007

Geographic Area



RATS Relay Setting, Changes due to Stability							
		Presque Isle to Empire		Presque Isle to National		Presque Isle to Empire	
Fault Location	Fault Type	Existing	New Stability	Existing	New Stability	Existing	New Stability
0-25%	3PG	2	3	2	3	2	3
	2PG	3	3	2	3	3	3
	1PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
25-100%	3PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	2PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	1PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
		Presque Isle to Cedar		Presque Isle to Freeman			
Fault Location	Fault Type	Existing	New Stability	Existing	New Stability		
0-35%	3PG	2	3	2	3		
	2PG	3	3	3	3		
	1PG	3	No Trip Sent	3	No Trip Sent		
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent		
35-100%	3PG	3	No Trip Sent	3	No Trip Sent		
	2PG	3	No Trip Sent	3	No Trip Sent		
	1PG	3	No Trip Sent	3	No Trip Sent		
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent		
		Presque Isle to Perch Lake					
Fault Location	Fault Type	Existing	New Stability				
0-30%	3PG	2	3				
	2PG	3	3				
	1PG	3	No Trip Sent				
	0PG	No Trip Sent	No Trip Sent				
30-50%	3PG	3	No Trip Sent				
	2PG	3	No Trip Sent				
	1PG	3	No Trip Sent				
	0PG	No Trip Sent	No Trip Sent				
50-100%	3PG	No Trip Sent	No Trip Sent				
	2PG	No Trip Sent	No Trip Sent				
	1PG	No Trip Sent	No Trip Sent				
	0PG	No Trip Sent	No Trip Sent				

RATS Relay Setting, Changes due to Stability							
Empire to Forsyth							
Fault Location	Fault Type	Existing	New Stability				
0-70%	3PG	2	No Trip Sent				
	2PG	3	No Trip Sent				
	1PG	3	No Trip Sent				
	0PG	No Trip Sent	No Trip Sent				
70-100%	3PG	3	No Trip Sent				
	2PG	3	No Trip Sent				
	1PG	3	No Trip Sent				
	0PG	No Trip Sent	No Trip Sent				
Cedar to National				Freeman to Cedar		Cedar to Tilden	
Fault Location	Fault Type	Existing	New Stability	Existing	New Stability	Existing	New Stability
0-100%	3PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	2PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	1PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
Tilden to National				Empire to National		White Clay to Morgan	
Fault Location	Fault Type	Existing	New Stability	Existing	New Stability	Existing	New Stability
0-100%	3PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	2PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	1PG	3	No Trip Sent	3	No Trip Sent	3	No Trip Sent
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	3	No Trip Sent

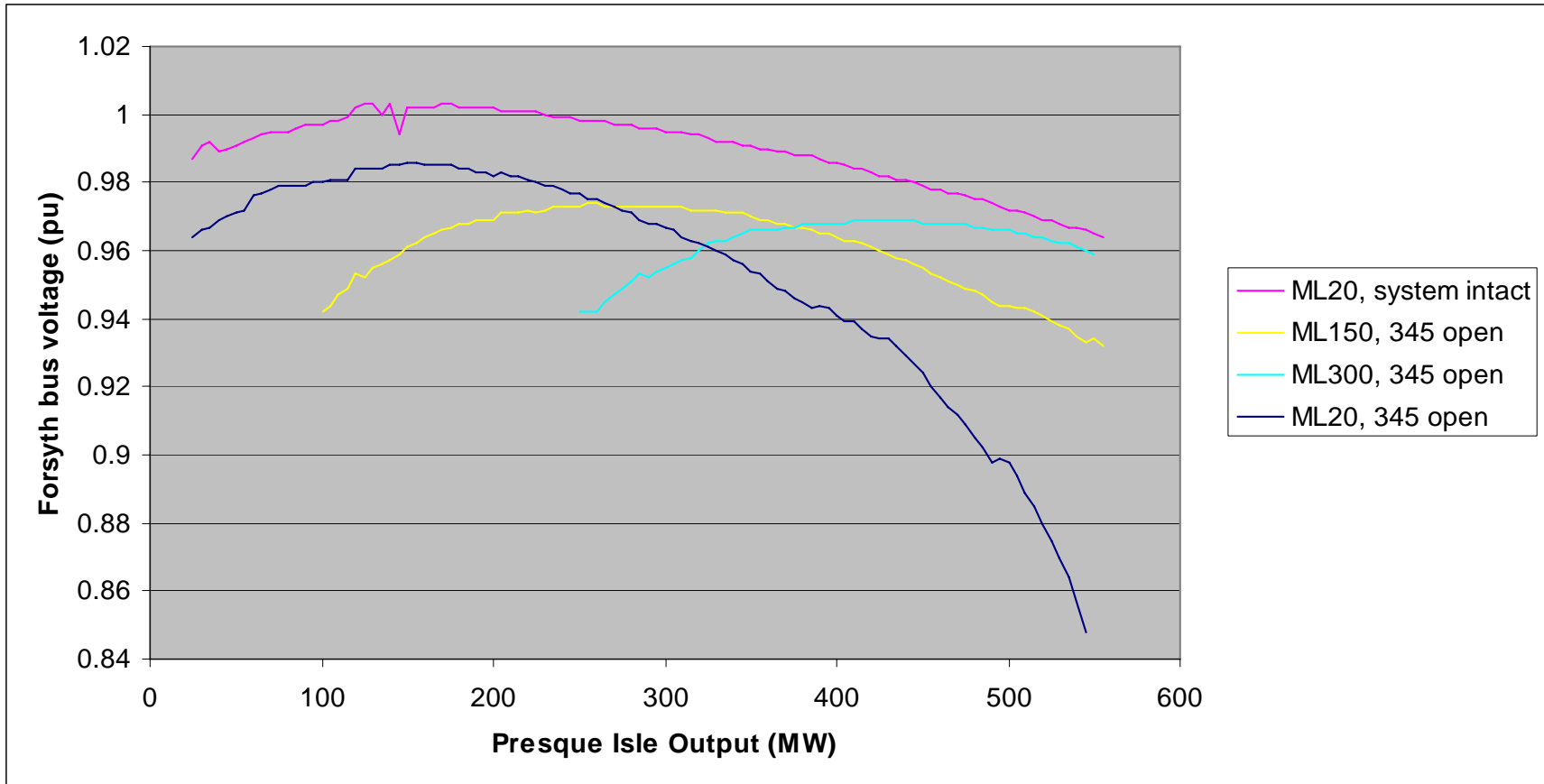
RATS Relay Setting, Changes due to Stability							
		Plains to Arnold		Plains to Amberg		Plains to Nordic	
Fault Location	Fault Type	Existing	New Stability	Existing	New Stability	Existing	New Stability
0-100%	3PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
	2PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
	1PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
	0PG	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent	No Trip Sent
		Plains to Morgan 345kV					
Fault Location	Fault Type	Existing	New Stability				
0-100%	3PG	3	3				
	2PG	3	3				
	1PG	3	3				
	0PG	3	3				

RATS Relay Setting, Elements that may change for Thermal Issues									
Presque Isle to Dead River 138kV					Plains 345kV/138kV Xfmr				
Fault Location	Fault Type	Existing	New Stability	Thermal	Fault Location	Fault Type	Existing	New Stability	Thermal
0-100%	3PG	1	1	1	0-100%	3PG	2	No Trip Sent	3
	2PG	1	1	1		2PG	2	No Trip Sent	3
	1PG	2	2	1		1PG	3	No Trip Sent	3
	0PG	2	3	1		0PG	3	No Trip Sent	3
Dead River 345kV to Plains 345kV									
Fault Location	Fault Type	Existing	New Stability	Thermal					
0-40%	3PG	2	2	1					
	2PG	2	2	1					
	1PG	3	3	1					
	0PG	3	3	1					
40-100%	3PG	2	2	1					
	2PG	2	2	1					
	1PG	3	3	1					
	0PG	3	3	1					

Example of Thermal Constraints

Table		8H Contingency: Dead River - Plains 345 kV									
Monitored line (ratings in MVA)		SN	SE	WN	WE						
Empire - Forsyth		195	202	201	229						
Season		100 Peak W to	100 Peak W to	100 Peak W to	100 Peak W to	100 Peak W to	100 Peak W to				
Mine load (MW)		20	20	20	150	150	150	300			
Presq. Output (MW)		556	487	413	556	531	442	556			
Flow North (MW)		442	377	306	316	292	208	168			
Flow North + Mine (MW)		462	397	326	466	442	358	468			
Marquette Net Export (MW)		30	30	30	30	30	30	30			
MW tripped for Level 1 (curve)		235	172	103	239	215	134	240			
MW tripped for Level 2 (curve)		192	101	0	124	95	0	107			
MW tripped for Level 3 (curve)		89	0	0	28	0	0	13			
Empire-Forsyth Over load %	No mine load trip	167	134	113	112	106	82	68			
Required lower PIPP (MW)	No mine load trip	365	360	360	490	490	490	556			
Required MW reduction	No mine load trip	191	127	53	66	41	0	0			
Empire-Forsyth Over load %	50% mine load trip	174	137	115	141	130	105	116			
Required lower PIPP (MW)	50% mine load trip	350	350	350	400	400	400	490			
Required MW reduction	50% mine load trip	206	137	63	156	131	42	66			
Empire-Forsyth Over load %	100% mine load trip	Not Converged	141	119	Not Converged	157	127	Not Converged			
Required lower PIPP (MW)	100% mine load trip	325	325	325	325	325	325	325			
Required MW reduction	100% mine load trip	231	162	88	231	206	117	231			
Worst Case % Loading Beyond Existing RATS		130	139	127	127	128	130	132			
	Flt location	Flt type	% mine load trip	Required Level	Required Level	Required Level	Required Level	Required Level	Required Level		
Dead River - Plains	0 to 40%	3PG	100	2 -> 1 (39 MW)	2 -> 1 (61 MW)	2 -> 1 (88 MW)	2 -> 1 (107 MW)	2 -> 1 (111 MW)	2 -> 1 (117 MW)	2 -> 1 (124 MW)	
		2PG / 2PP	50	2 -> 1 (14 MW)	2 -> 1 (36 MW)	2 -> 1 (63 MW)	2 -> 1 (32 MW)	2 -> 1 (36 MW)	2 -> 1 (42 MW)	2	
		1PG	0	3 -> 2 (102 MW)	3 -> 1 (127 MW)	3 -> 1 (53 MW)	3 -> 2 (38 MW)	3 -> 2 (41 MW)	3	3	
		open line	0	3 -> 2 (102 MW)	3 -> 1 (127 MW)	3 -> 1 (53 MW)	3 -> 2 (38 MW)	3 -> 2 (41 MW)	3	3	
	40 to 100%	3PG	50	2 -> 1 (14 MW)	2 -> 1 (36 MW)	2 -> 1 (63 MW)	2 -> 1 (32 MW)	2 -> 1 (36 MW)	2 -> 1 (42 MW)	2	
		2PG / 2PP	0	2	2 -> 1 (26 MW)	2 -> 1 (53 MW)	2	2	2	2	
		1PG	0	3 -> 2 (102 MW)	3 -> 1 (127 MW)	3 -> 1 (53 MW)	3 -> 2 (38 MW)	3 -> 2 (41 MW)	3	3	
		open line	0	3 -> 2 (102 MW)	3 -> 1 (127 MW)	3 -> 1 (53 MW)	3 -> 2 (38 MW)	3 -> 2 (41 MW)	3	3	
	Presque Isle - Dead River	0 to 100%	3PG	100	1	1	1	1	1	1	1
			2PG / 2PP	100	1	1	1	1	1	1	1
			1PG	50	2 -> 1 (14 MW)	2 -> 1 (36 MW)	2 -> 1 (63 MW)	2 -> 1 (32 MW)	2 -> 1 (36 MW)	2 -> 1 (42 MW)	2
			open line	0	2	2 -> 1 (26 MW)	2 -> 1 (53 MW)	2	2	2	2

Presque Isle output vs. Voltage



Notes:

1. ML is the total Empire + Tilden mine load in MW.
2. 345 open means the Dead River – Plains 345kV line is out of service
3. Transformer LTCs were locked due to convergence issues with letting them adjust at high PI output.
4. Switch shunts, phase shifters, and DC ties were allowed to adjust normally.

Potential Green Bay Area Issues for Level 1 Tripping

Case	Peak, W-E Bias
Mine load (MW)	300
Presq. Output (MW)	556
Flow North (MW)	168
Flow North + Mine (MW)	468
Marquette Net Export (MW)	30
MW tripped for Level 1 (curve)	240
MW tripped for Level 2 (curve)	107
MW tripped for Level 3 (curve)	13

High W-E Bias less 1000MW transfer from ComEd to METC

High Bias-1000MW			
MW reduced	New PI Output	NAP-LWN overload	PUL-STI overload
240	316	101%	98%
288	268	107%	107%
292	264	108%	108%

High W-E Bias

High Bias			
MW reduced	New PI Output	NAP-LWN overload	PUL-STI overload
240	316	104%	102%
288	268	110%	112%
292	264	111%	113%

Notes:

1.PI=556-240=316MW. 240MW is the calculated value for a level 1 trip when PI is at 556MW and the mines are at 300MW.

2.PI=556-288=268MW. 288MW is the calculated value with 20% additional.

3.PI=556-292=264MW. When all units are at Pmax, it's impossible to trip exactly 240MW or 288MW. The Flow South page on EMS implies PI will select units 3 and 4 first, 5 and 6 second, and 7, 8, or 9 last. The choice is up to PI, of course, but 292MW is the loss of units 3-6 at Pmax.

Other thermal issues

- Plains 345/138-kv Transformer Results

Table 16 Analysis of Plains 345/138 kV transformer for the loss of Plains-Morgan 345 kV

Scenario	Ratings (MVA)	Mine load (MW)	PIPP (MW)	% load tripped	% ovl	Flow North	% ovl at 550 MW	% ovl at 540 MW	% ovl at 530 MW	% ovl at 520 MW
100% peak East to West	250	20	556	0	103	448	101	99	97	95
100% peak East to West	250	20	556	50	105	448	103	101	99	97
100% peak Split	250	20	556	0	105	448	104	101	99	97
100% peak Split	250	20	556	50	107	448	105	103	101	99

Comments: Level 3 trip addresses Plains transformer overloading for all conditions.

- Dead River-Plains 345-kV contingency could overload Presque Isle-Perch Lake but Level 1 trip will mitigate as well