

# SPA Update & Constraint Mitigation Kickoff

SE MN-IA Group  
Buffalo Ridge Area Group  
Big Stone Area Group  
ND Group  
SD Group

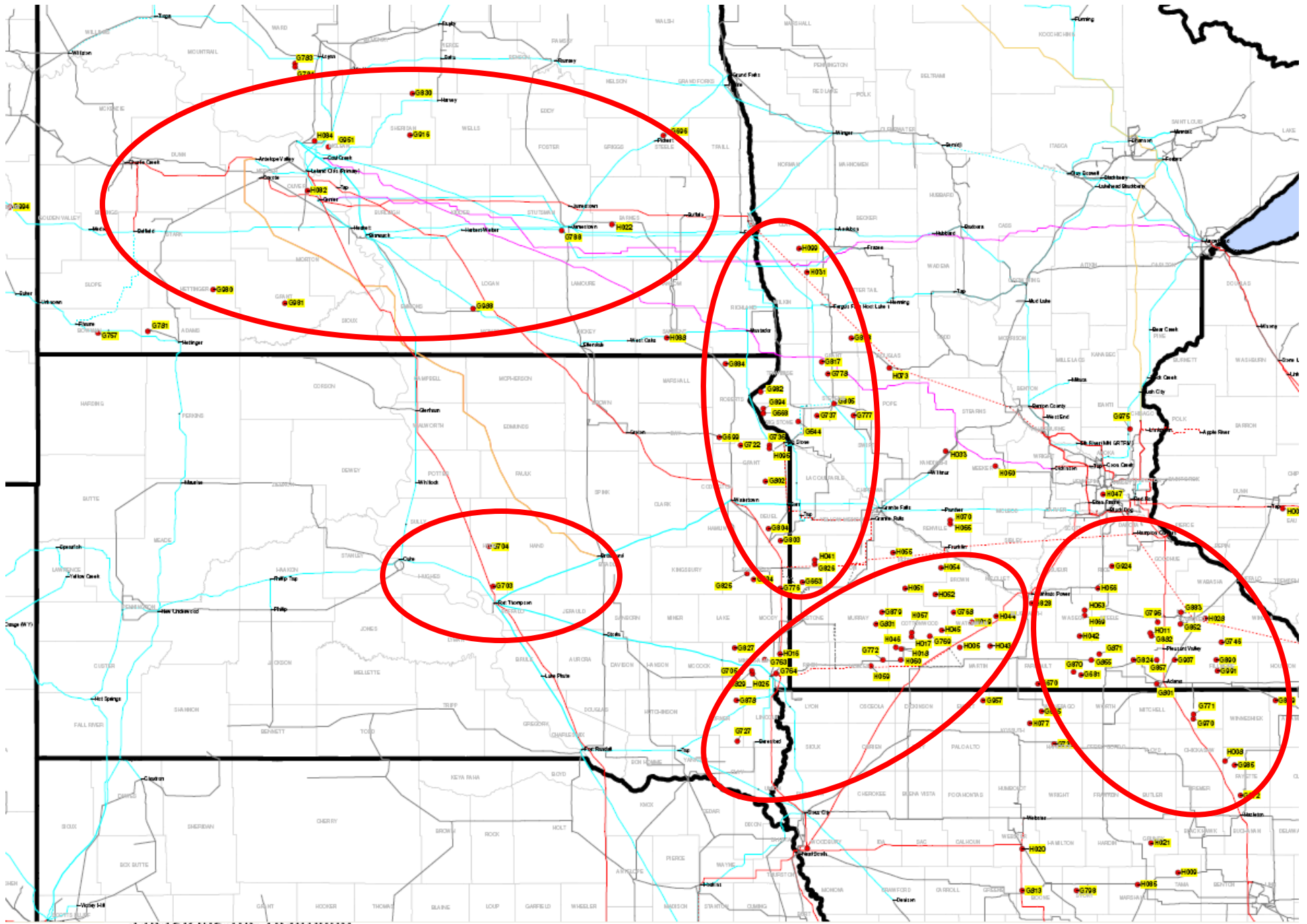
- “Learn the fundamentals of the game and stick to them. Band-aid remedies never last”
  - Jack Nicklaus (legendary professional golfer)
- “Problems do not go away. They must be worked through or else they remain, forever a barrier to the growth and development of the spirit”
  - Scott Peck (psychiatrist and best-selling author)

# Overview

- Recap
- Notes on interpretation of results
- Summary of posted results
- Some testing results
- Mitigation Plans
- Next step

# Group Definitions

- South Dakota
  - 4 projects
  - 5750 MW
- MT-ND Group
  - 31 projects
  - 7905 MW
- Buffalo Ridge Area
  - 32 projects
  - 3574 MW
- South East MN-IA
  - 51 projects
  - 12636 MW
- Big Stone Area
  - 52 projects
  - 12527 MW



Emerging the Redlands

# Recap

*(Slide from the kick-off meeting)*

## High Level Study Approach

- Focus on constraints and mitigations as opposed to projects
- Use existing study work to the extent possible
  - If mitigations were identified or considered in the old process, model them in the new base cases and take it from there
- Identify regional solutions for the group as a whole and then derive answers for individual projects (i.e cost allocation, local upgrades etc)
- Expedite projects within the group that do not contribute to constraints

# Recap

*(Slide from the kick-off meeting)*

## Initial Screening

- Using DC solution method, identify the universe of constraints for the group under summer peak and shoulder peak conditions
- Identify impact of study generators on above constraints using
  - System intact (N-0) cutoff : 5% DF
  - Category B/C cutoff : 20% DF  
: 5% DF for NRIS

# Recap

*(Slide from the kick-off meeting)*

## **Initial Screening cont.**

- If a generator doesn't impact any constraints per the DF criteria, process it separately in an expedited manner
- Record the impacts of all projects on all constraints for future use in cost allocation
- Compile a list of all constraints and overloads for further processing



# Caution

- Do not draw any conclusion on an individual project based on these results
- Results generated in less than 2 months for all 54 GW that was in SPA – they are indeed “preliminary”
- Do not compare these with transition feasibility study results – they are apple and oranges
- Do not compare the results of 2 projects based on their geographical proximity

# What is not conclusive

- If my project is impacting 50 lines, I will be responsible for fixing those 50 lines
- My project in ND is impacting a line in WI, it cant connect until I fix that constraint

# What is not correct

- All of 42 GW generation will get answer at the same time
- Newer projects included in analysis will slow down the processing of older projects
- Projects will exit SPA strictly in queue order
- Mitigation will include mostly 765 kV lines to accommodate 42 GW of generation in Western SPA groups

# Purpose of Preliminary Analysis

- Identify major system limitations
- Get an indication of all the work ahead of us
- Get some clues to prioritize the constraint mitigation effort
- Identify if there are any low hanging fruits (i.e. smaller projects at better locations)

# Interpretation of the preliminary results

- Elements that are severely constrained are being utilized by most projects
- Such elements are also key outlets off the region
- Can be considered as a substitute for copper sheet analysis in promod – gives an idea of congested corridors and power flow pattern
- A transmission plan to mitigate such overloads will benefit a large number of projects
- Likely such a solution will also fix multiple other smaller problems

# Summary of posted results

# Preliminary Results

- Constraints
  - In the first round, plan to focus on
    - Summer off peak
    - 230 and 345 kV
    - Non transformer
    - Highest loaded constraints

# Preliminary Results <230 kV

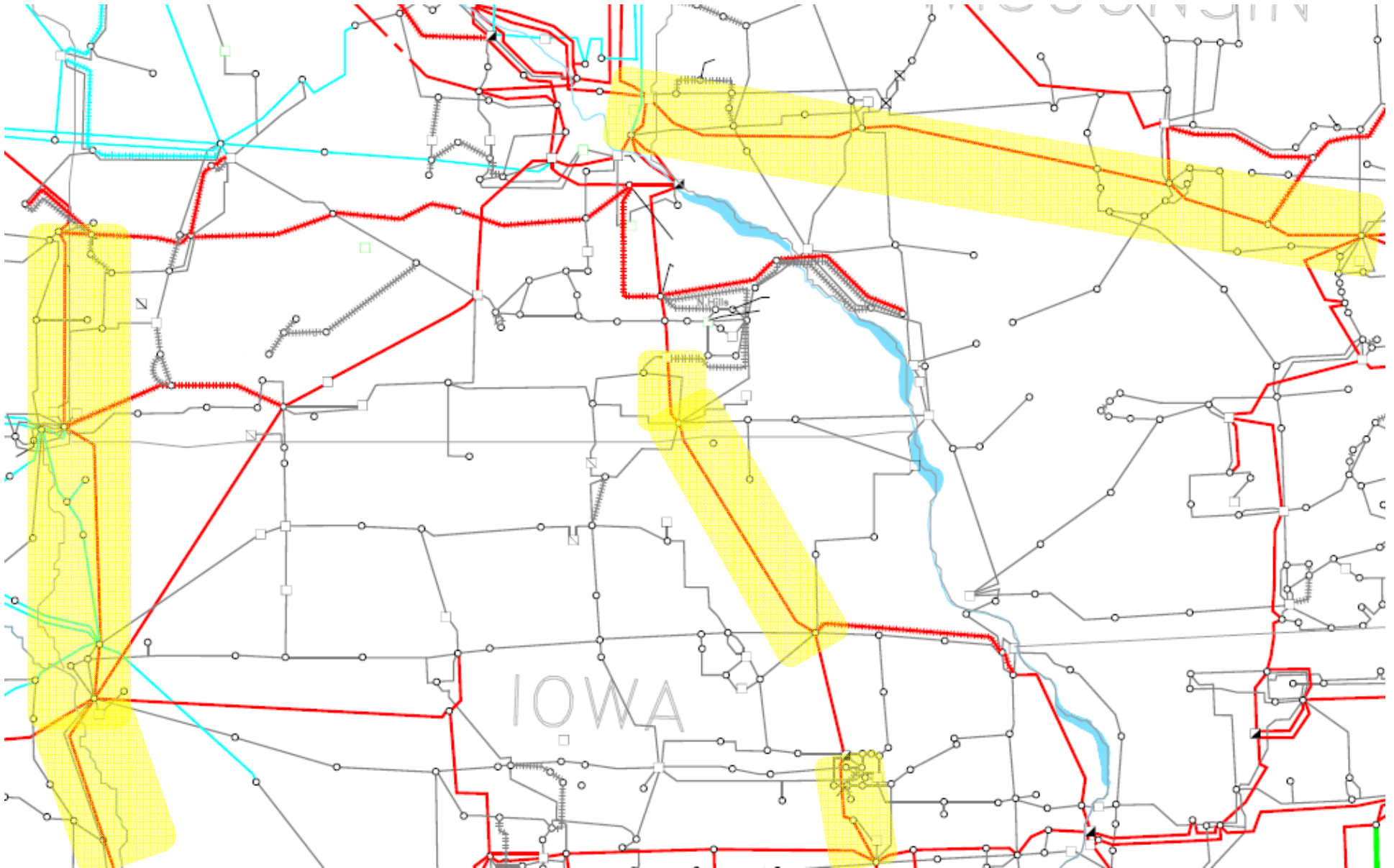
Loading Level	100-199%	200-299%	>400%
Branches	128	47	7
Transformers	43	18	3
Total	171	65	10



# Regional Bottlenecks

- Pleasant Valley – Adams – Hazleton 345 kV
- Arnold – Tiffin 345 kV
- King – Eau Claire – Arpin – Rocky Run – West Werner – Appleton 345 kV
- White – Split Rock – Sioux City 345 kV
- Raun – S3451 3 345 kV

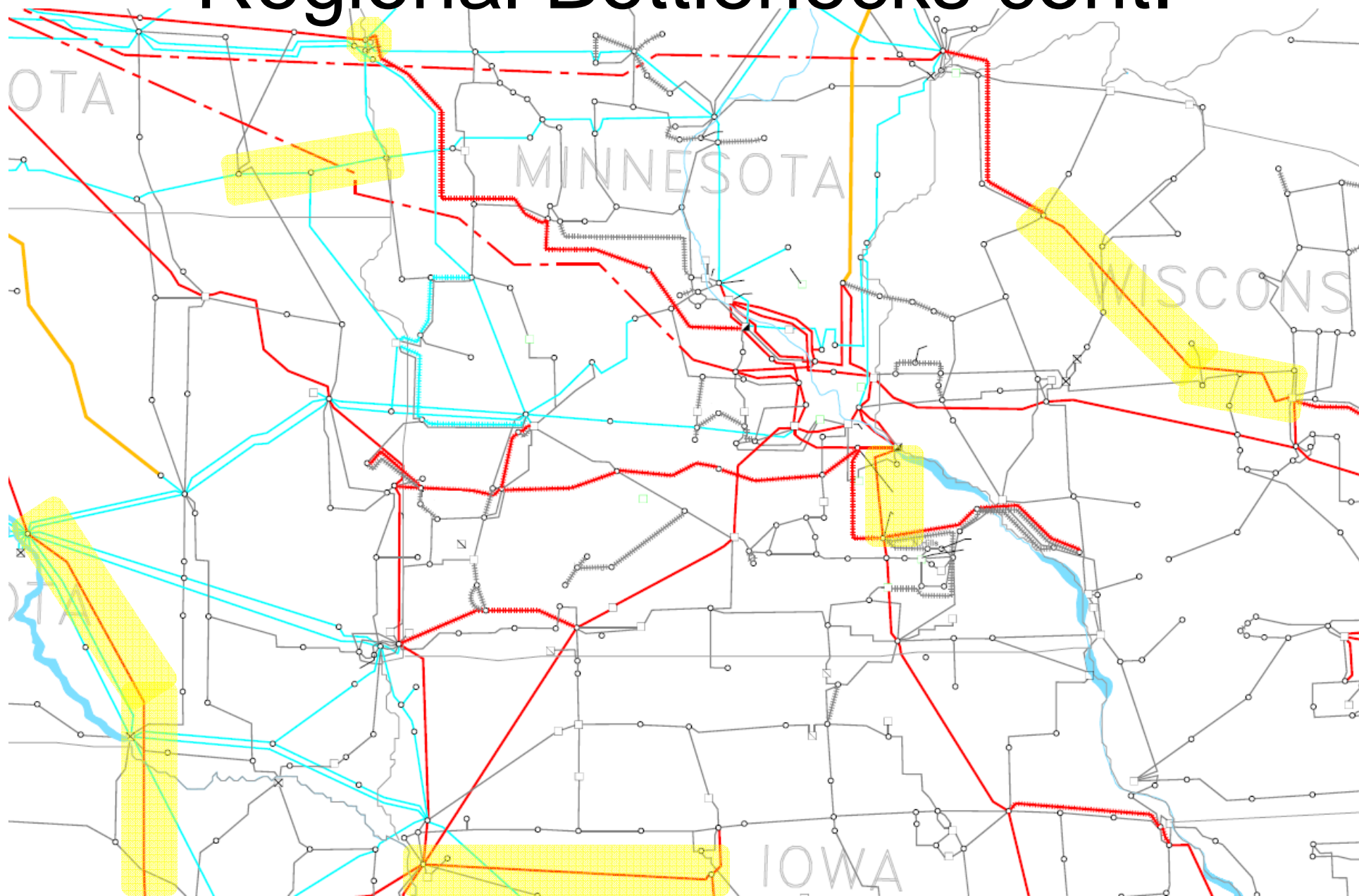
# Regional Bottlenecks



# Regional Bottlenecks cont.

- Maple River transformers \*
- Ft. Thompson – Grand Island 345 kV
- Ellendale – Forman – Hankinson 230 kV
- Raun – Lehigh 345 kV \*
- Prairie Island – North Rochester 345 kV
- Stone Lake – Weston 345 kV

# Regional Bottlenecks cont.



# GS6 mitigations testing results & mitigation plans for next round

# Introduction

- GS-6 had 21 projects out of which 9 projects were transferred to DPP
  - 12 projects transferred to SPA for further analysis
- NORDAGS II had 9 projects out of which 2 projects are inactive
  - 7 projects transferred to SPA for further analysis

# GS6 (Major) Constraints

- Morris – Johnson Jct. 230 kV
- Morris – Granite Falls 230 kV
- Big Stone – Blair 230 kV
- Blue Lake – Helena 345 kV
- Big Stone 345/230 kV transformers
- Hayward – Winnebago 161 kV
- Adams 345/161 kV transformers

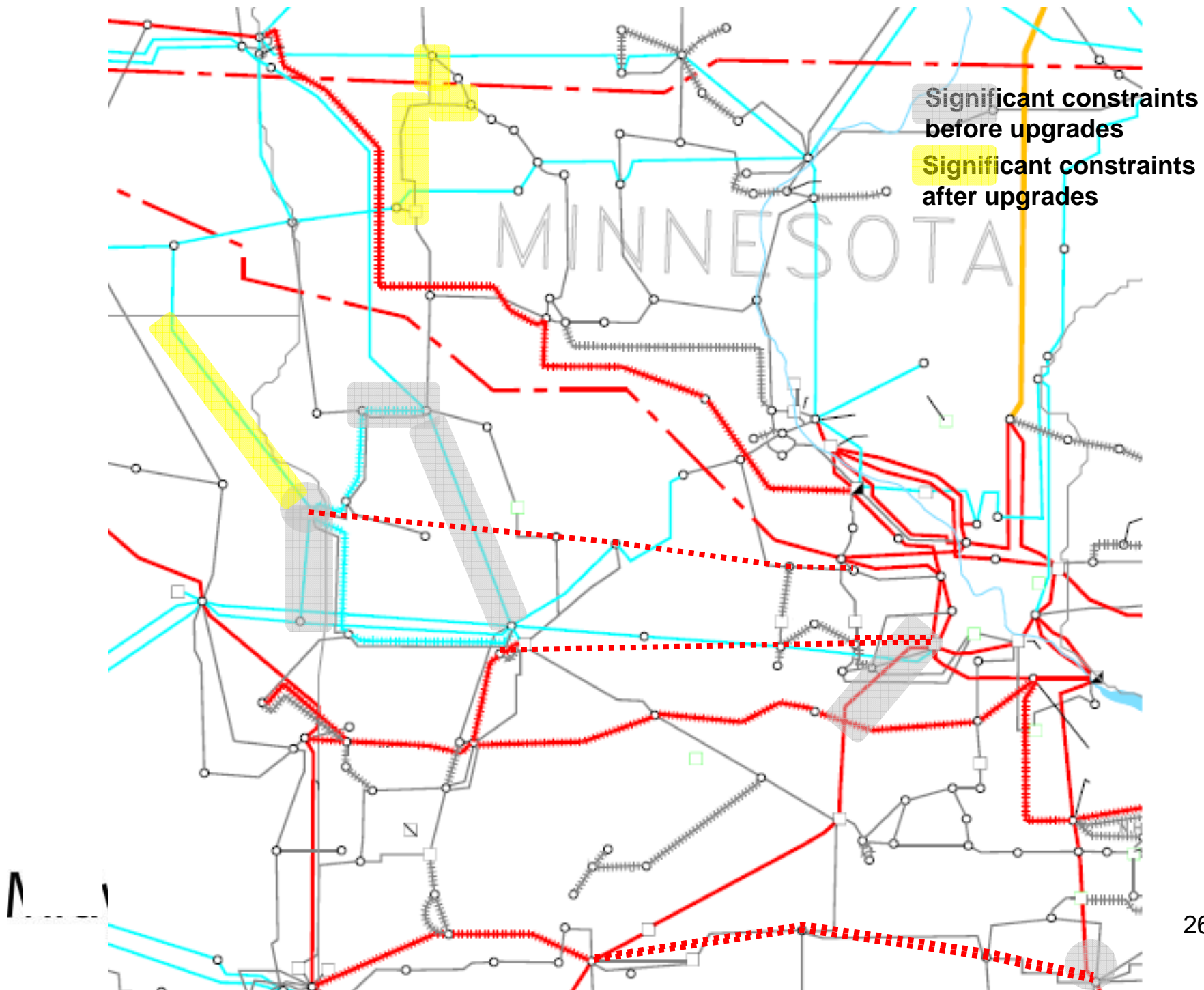
# GS6 Mitigation

- Big Stone – Big Swan – Crow River 345 kV
- Hazel – West Waconia 345 kV
- Double circuit West Waconia – Blue Lake 345 kV
- Double circuit Lakefield – Adams 345 kV



# GS6 Results after Mitigation

- Major Constraints
  - Big Stone – Browns Valley 230 kV
  - Big Stone 345/230 kV transformer
- Minor Constraints
  - Hoot Lake – Fergus Falls 115 kV
  - Audubon – Cormorant – Frazee 115 kV
  - Cormorant – Tamarack – Pelican Rapids 115 kV



# NORDAGS II (Major) Constraints

- Maple River – Sheyenne 230 kV
- Ellendale – Forman 230 kV
- Bowman – Rhame 230 kV
- Transformers
  - Maple River 345/230 kV
  - Buffalo 345/115 kV
  - Ellendale, Hettinger, and Heskett 230/115 kV

# NORDAGS II Mitigation

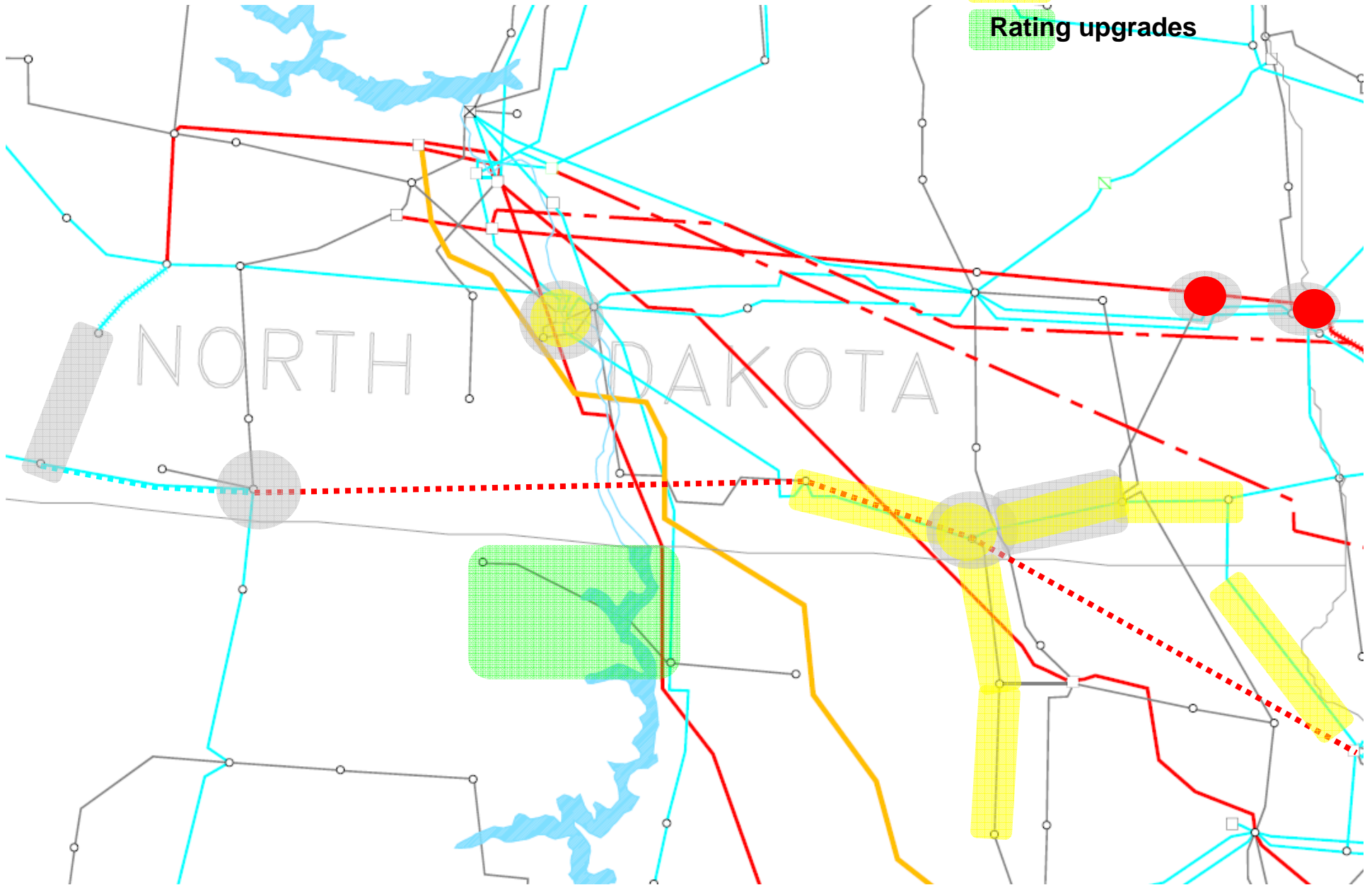
- New Hettinger – Wishek – Ellendale – Big Stone 345 kV
- 2<sup>nd</sup> Hettinger – Bowman 230 kV
- 4<sup>th</sup> Maple River 345/230 kV transformer
- 2 new Buffalo 345/115 kV transformers
- Upgrade Glenham 230/115 kV transformers and Glenham – McLaughlin 115 kV (shaded)

# NORDAGS II Results after Mitigation

- Major Constraints
  - Big Stone – Browns Valley 230 kV
  - Big Stone 345/230 kV transformer
  - Hankinson – Forman – Oakes – Ellendale – Wishek 230 kV
- Other Constraints
  - Ellendale – Aberdeen – Redfield 115 kV
  - Ellendale and Heskett 230/115 kV transformers

# NORDAGS II

- Constraints before upgrades
- Constraints after upgrades
- Rating upgrades



# GS6 first iteration summary

- Mitigations proposed in GS6
  - Big Stone – Big Swan – Crow River 345 kV
  - Hazel – West Waconia 345 kV
  - Double circuit West Waconia – Blue Lake 345 kV
  - Double circuit Lakefield – Adams 345 kV
- Remaining constraints
  - Big Stone 345/230 kV transformers
  - Big Stone 230 kV line
  - Outlet issues for a project

# Mitigation plans for remaining constraints

- Big Stone 230/345 kV transformers
  - Increase size of Big Stone transformers
- Big Stone 230 kV line
  - Bundle 230 kV lines



# Projects ready for detailed analysis

MISO Project Num	Group Name	Service Type	Control Area	Max Summer Output	Fuel Type	POI
G643	South East MN-IA Group	NR	ALTW	20	Wind	Osage 69 kV
G663	Big Stone Area Group	ER	NSP	19.8	Wind	Yankee 115 kV
G668	Big Stone Area Group	NR	GRE	100	Wind	Johnson Jct. 115 kV
G670	South East MN-IA Group	NR	NSP	200	Wind	Hayward -- Winnebago 161 kV
G680	Big Stone Area Group	ER	OTP	20	Wind	Burr -- Toronto 115 kV
G681	South East MN-IA Group	NR	ALTW	50	Wind	Alden -- Alexandria West 69 kV
G695	South East MN-IA Group	ER	ALTW	200	Wind	Winnebago -- Winnco 161 kV

# Projects that require further mitigations

MISO Project Num	Group Name	Service Type	Control Area	Max Summer Output	Fuel Type	POI General
G622	MT-ND Group	ER	MDU	150	Wind	Tatanka 230 kV
G624	MT-ND Group	NR	MDU	150	Wind	Wishek 115 kV
G644	Big Stone Area Group	ER	OTP	20	Wind	Walden -- Morris Tap 115 kV
G650	MT-ND Group	ER	WAPA	99	Wind	Stanley 115 kV
G662	MT-ND Group	ER	MDU	100	Wind	McLaughlin 115 kV
G690	MT-ND Group	NR	MDU	200	Wind	Ellendale 230 kV
G696	MT-ND Group	NR	OTP	280	Wind	Buffalo 345 kV
G697	Big Stone Area Group	ER	OTP	20	Wind	Hoot Lake 115 kV
G699	Big Stone Area Group	NR	OTP	250	Wind	Browns Valley 230 kV
G713	MT-ND Group	NR	MDU	200	Wind	Wishek 230 kV
G721	Big Stone Area Group	NR	GRE	160	Wind	Tamarac -- Pelican Lake 115 kV
G722	Big Stone Area Group	NR	OTP	250	Wind	Big Stone 230 kV

# Still some study work Needed

- Mitigation is needed for:
  - Big Stone – Browns Valley 230 kV
  - Hankinson – Forman – Oakes – Ellendale – Wishek 230 kV
  - Hoot Lake – Fergus Falls 115 kV
  - Audubon – Cormorant – Frazee 115 kV
  - Cormorant – Tamarack – Pelican Rapids 115 kV
  - Ellendale – Aberdeen – Redfield 115 kV
  - Ellendale and Heskett 230/115 kV transformers

# Mitigation options for GS6 ND2 constraints

- Hoot Lake – Fergus Falls 115 kV
  - Short line consider reconductoring
- Audubon – Cormorant – Frazee and Cormorant – Tamarack – Pelican Rapids 115 kV
  - 345 kV collector system in the Audubon area (and further south, 115 kV system) for connection to Maple River – Alexandria 345 kV
  - Alternate Option
    - Build 230 kV line keep existing 115 kV (Audubon and further south, on the 115 kV system)

## Mitigation option for GS6 ND2 constraints cont.

- Big Stone – Browns Valley 230 kV
  - Potential rebuild or raising of structures to increase ratings
  - Pending additional outlet needs possible a new 230 kV outlet over to Johnson Jct.
- Hankinson – Forman – Oakes – Ellendale – Wishek 230 kV, Ellendale – Aberdeen – Redfield 115 kV, Ellendale and Heskett 230/115 kV transformers
  - Double 345 kV ckt from Maple River – Jamestown – Center – Ellendale
    - Double 345 kV ckt from Jamestown -- Ellendale

# Potential options for next round mitigation

- LaCrosse – Middleton 345 kV
- Lakefield – Adams 345 kV (double ckt.)
- Lakefield – Wright – Hazleton 345 kV
- Split Rock – Webster 345 kV
- Nobles – Lyon County 345 kV
- Double ckt. Brookings – Lyon County 345 kV
- Second double ckt. Brookings – Rochester 345 kV
- Hazel – Blue Lake 345 kV double ckt  
– Removal of 230 kV

# Potential options for next round mitigation

- Big Stone – Alexandria 345 kV
- Big Stone – Willmar – Dickinson (Crow River) 345 kV
- Antelope Valley – Broadland – Split Rock 500 kV (using existing 345 kV operated portion of line)
  - Parallel 500 kV line with Antelope Valley – Split Rock 500 kV
- Double ckt. Maple River – West St. Cloud 345 kV
- Double 345 kV ckt from Maple River – Jamestown – Center – Ellendale
  - Double 345 kV ckt from Jamestown -- Ellendale

# Potential options for next round mitigation

- App. C:
  - RIGO
  - Maple River – Blue Lake 500 kV
    - Keep going east to Rochester or West Middleton
    - Possibly start at Antelope Valley
- Optimization of Maple River – St. Cloud CAPX2020 345 kV line
- Move POIs to Big Stone 345 kV from 230 kV
- Lower kV
  - New Glenwood – Alexandria 115 kV (smaller projects 20-40 MW)



# Some Alternatives discussed

- Big Stone – Brookings County 345 kV
- Benton Co. – Chisago 345 kV
- LaCrosse – Genoa – Nelson Dewey – tap on Hazleton to Salem 345 kV

# Parking lot ideas

- Center – White 345 kV
  - Connection at Ellendale
- Hettinger – Ellendale 765 kV
- Big Stone or Brookings County – Sullivan or Plano 765 kV
- DC line from SW MN to East

# Next Step

# Study Approach this point onward

- Test transmission plans in phases and process GI requests in chunks, accommodating the older ones first to the extent possible
- Keep advancing sub groups of GIRs to the next level (i.e. AC powerflow, stability, SC etc) while working on remaining GIRs in each group
- Once all 230, 345 kV issues resolved, most other issues seem to be manageable, allow projects to go to the DPP

# Goals for the next Quarter

- Identify a subset of Gens in each group that can go to the next level
- Continue testing plans, run AC powerflow on plans that look promising
- Begin Stability for Gens that look okay thermally

# Future Updates

- Conference calls to discuss issues as needed
- Face to face meeting in late May or June
- Monthly progress reports via email
- Any interest in a 2 hrs webcast in about 6 weeks?

# Questions?