



Shaping the Region for 50 Years.

**ND Water Education Foundation's
Executive Briefing on Fargo Flood Risk Reduction
July 13, 2012**

Consulting Engineering • Land Surveying
West Fargo, ND • Fergus Falls, MN

North Dakota Wild Rice River Watershed Study

Joint Effort!

Richland-Cass Joint Water Resource District

Formation of Joint Board – WRD's Working Together!

Acknowledgements: Houston Engineering & Barr Engineering

North Dakota Wild Rice River Watershed Study

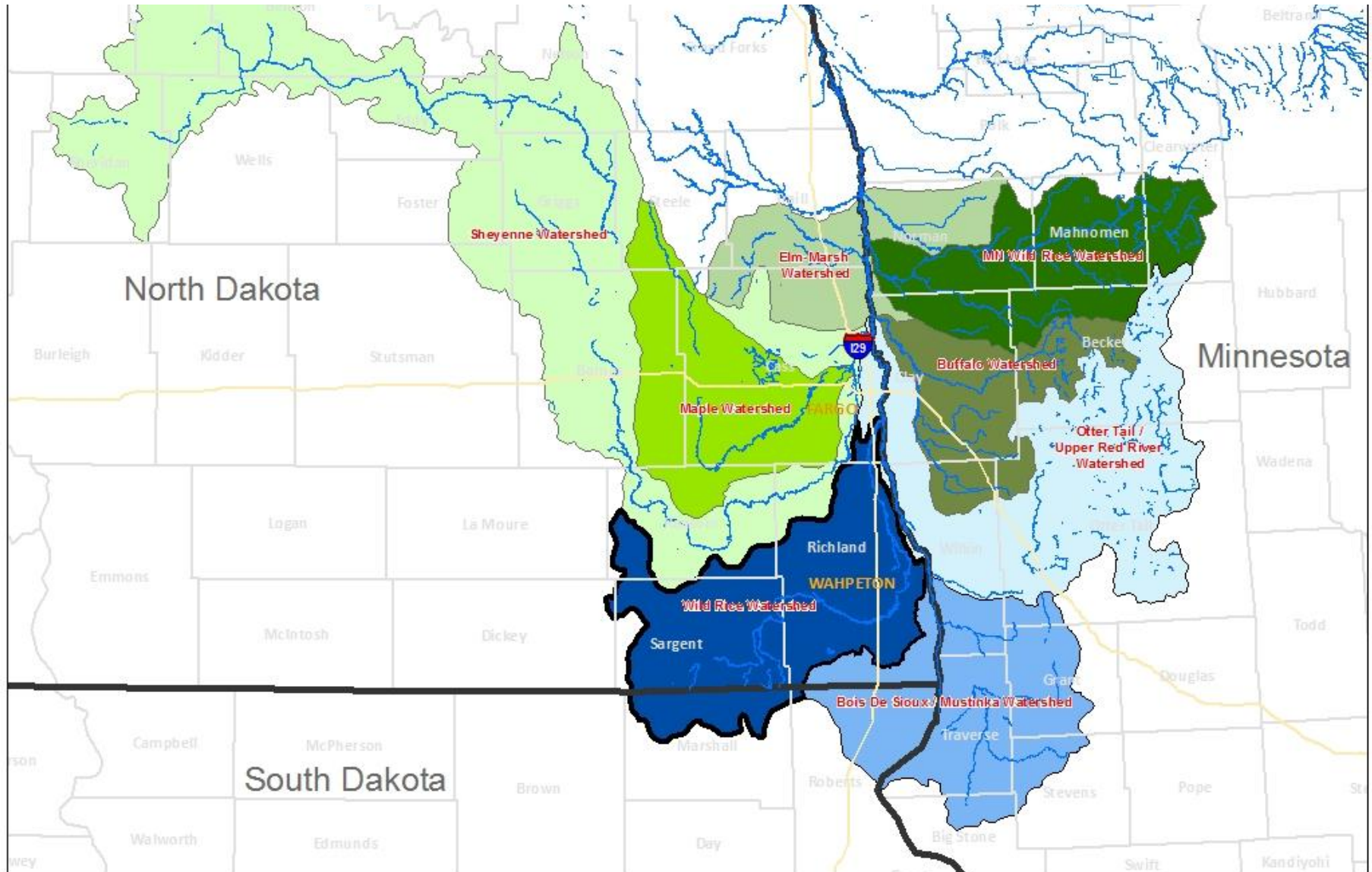
- CONCLUSIONS
- BACKGROUND
- HISTORIC EVENTS
- RETENTION
- MODELING
- CONCLUSIONS

CONCLUSIONS

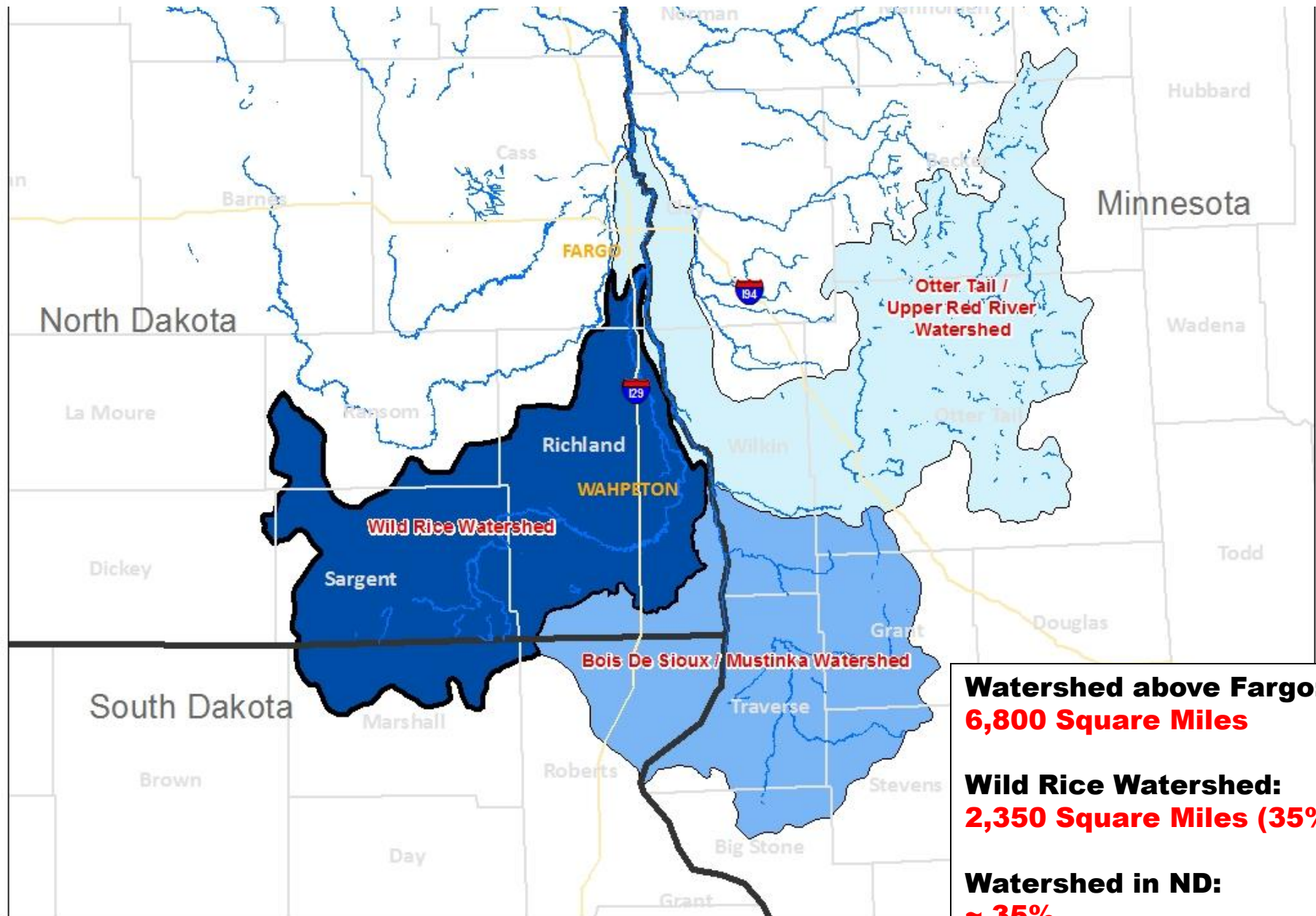
- The historic record of Wild Rice floods shows a repeating pattern of similarity. This includes 2009, 2010, and 2011. There is 1 exception.
- 1997 flood is significantly different; it is not typical.
- Modeling shows the Upper Wild Rice Watershed does not contribute to the Red River crest at Fargo. Timing!
- Wild Rice Retention modeling shows strong potential for local benefits within the Wild Rice Watershed.
- Wild Rice Retention modeling shows diminished benefit to the Red River at Fargo.

UPPER RED RIVER WATERSHED HEC-HMS MODEL

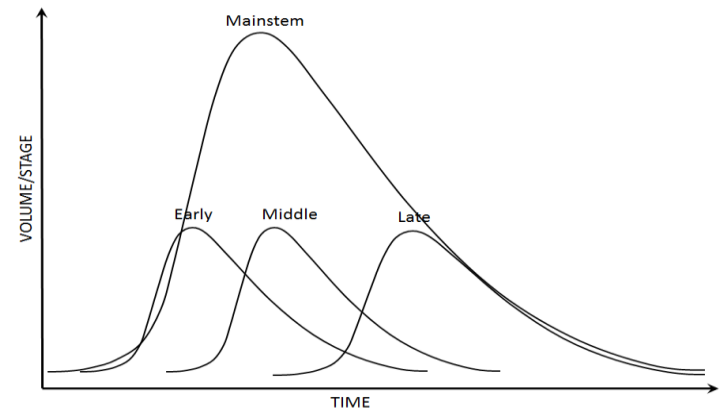
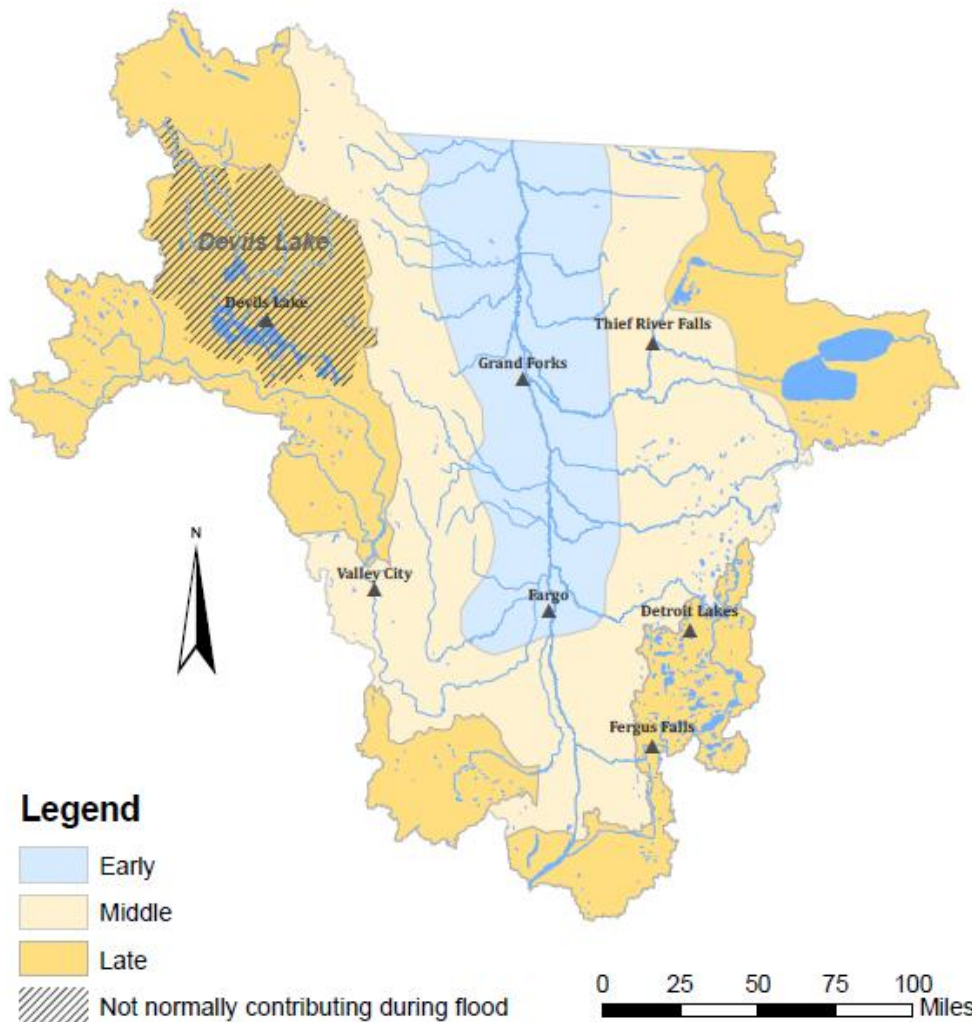
LiDAR based Hydrologic Model



Watershed Upstream of Fargo



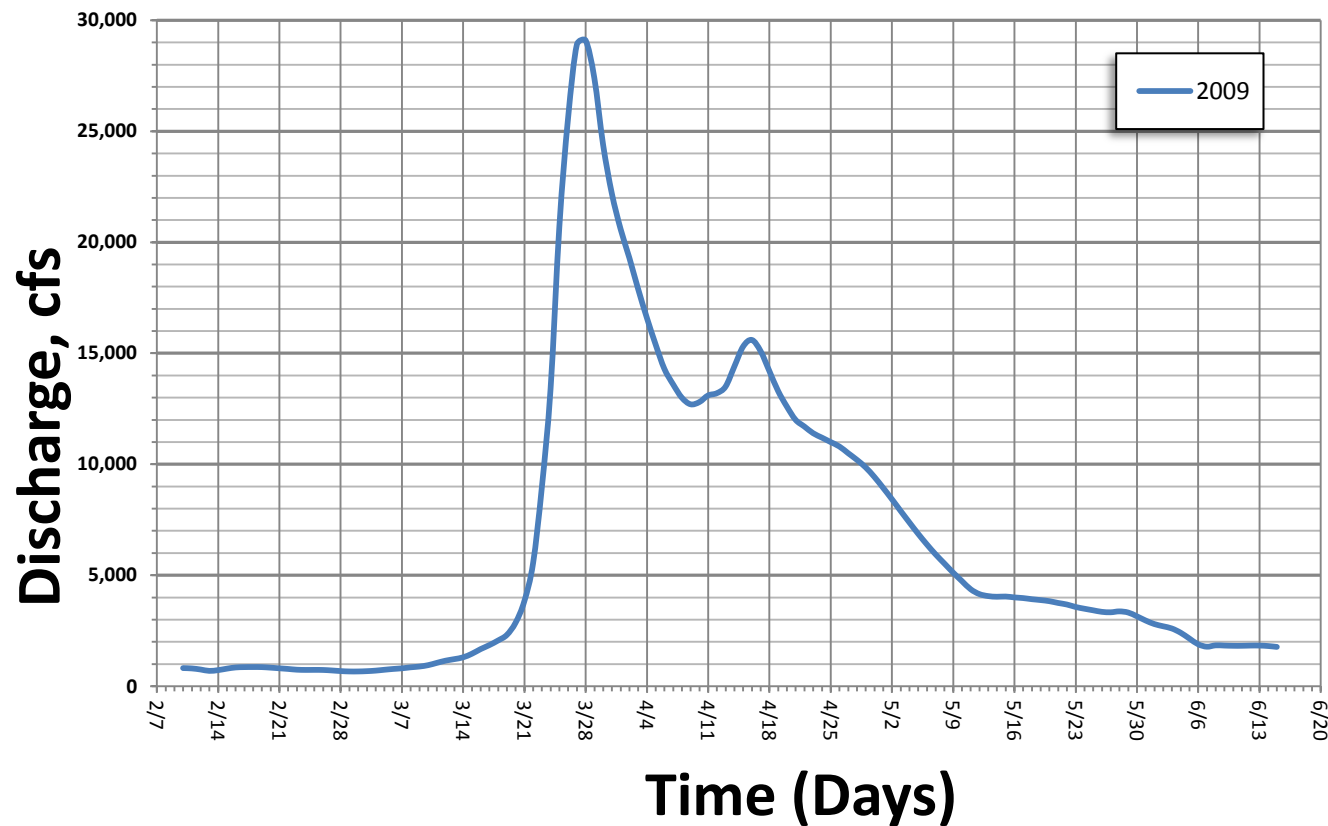
Early, Middle, and Late Water Concept



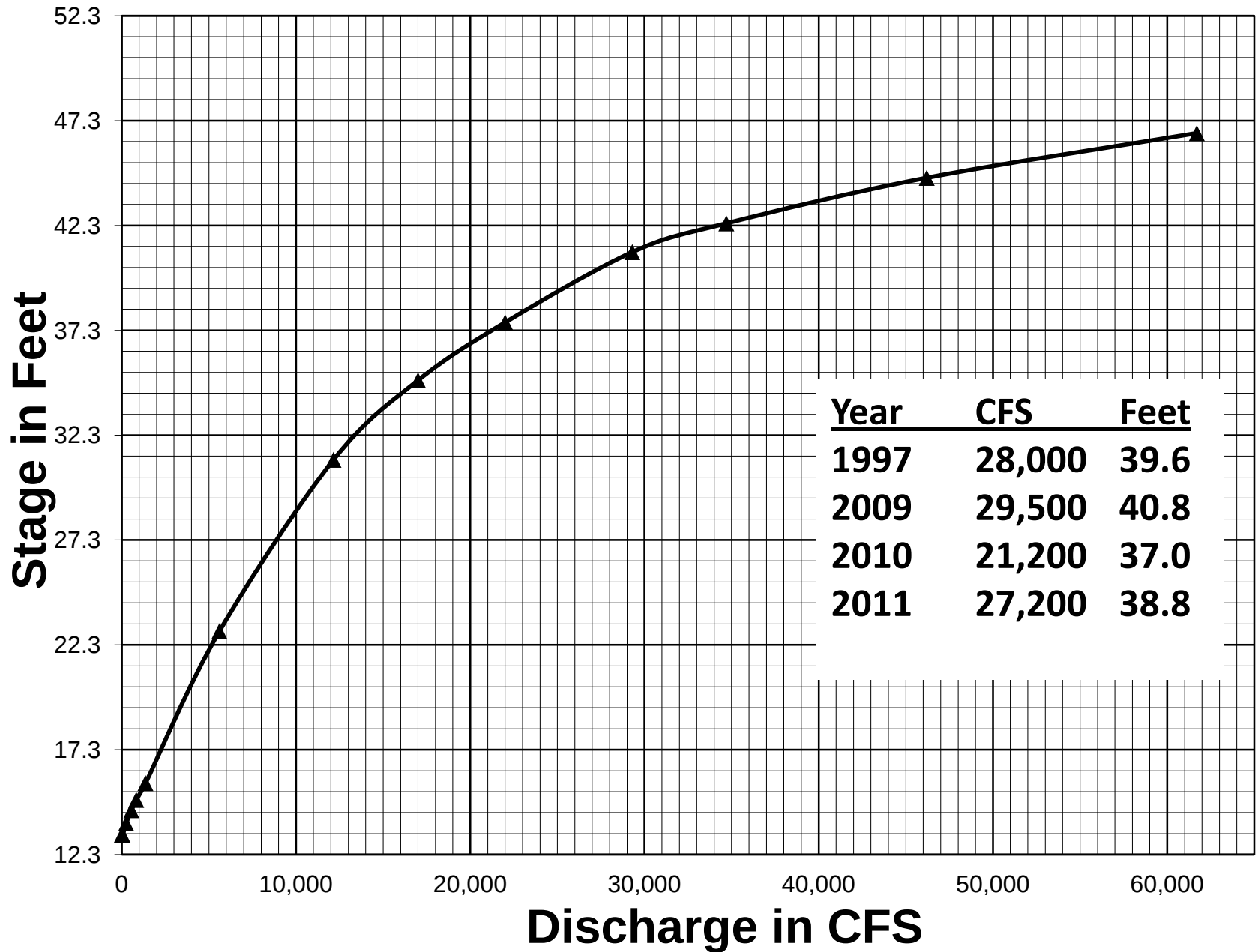
TIMING

What is a Hydrograph?

Discharge Hydrograph at Fargo USGS Gage



FARGO GAGE – RATING CURVE

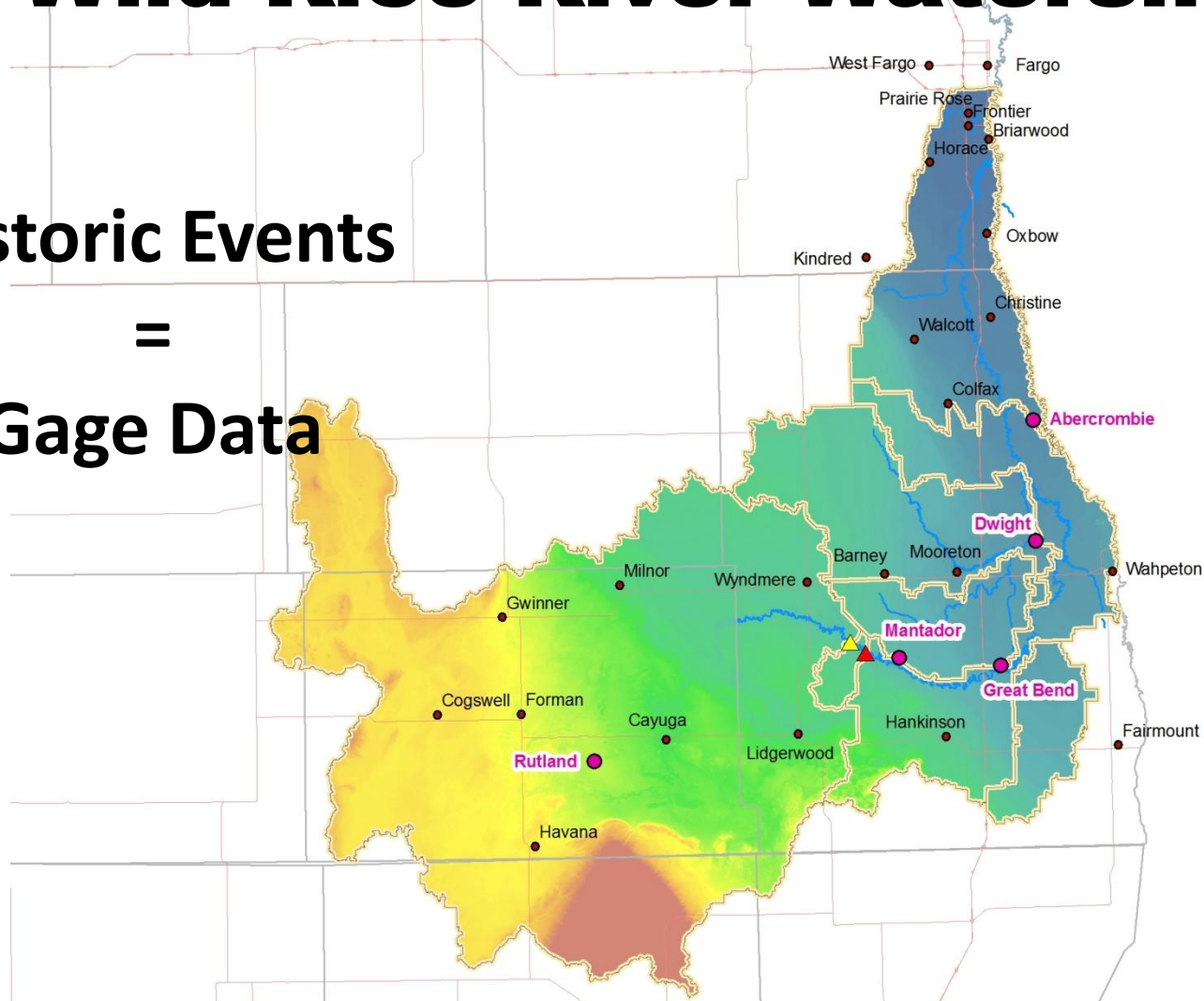


Wild Rice River Watershed

Historic Events

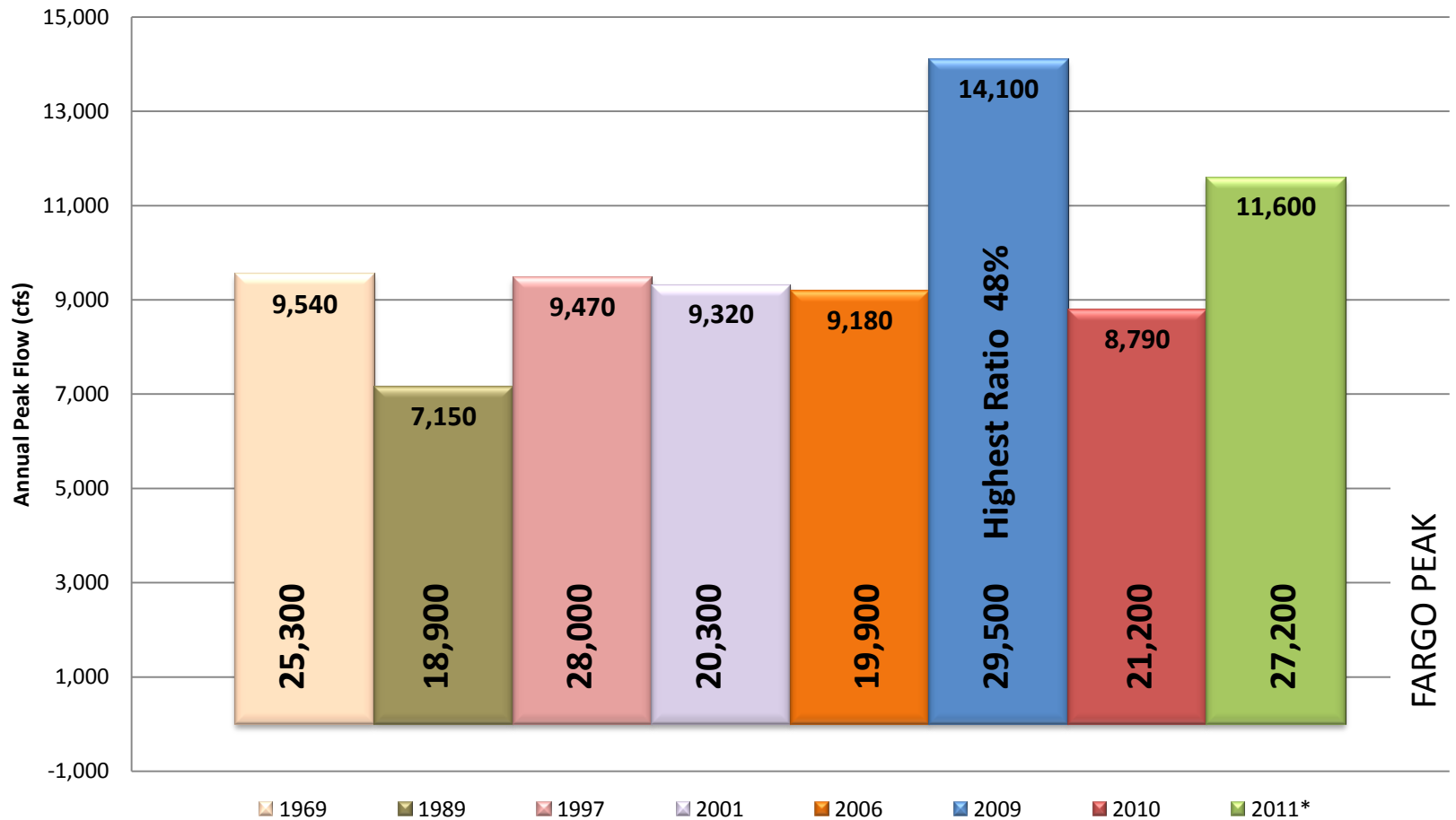
=

Gage Data



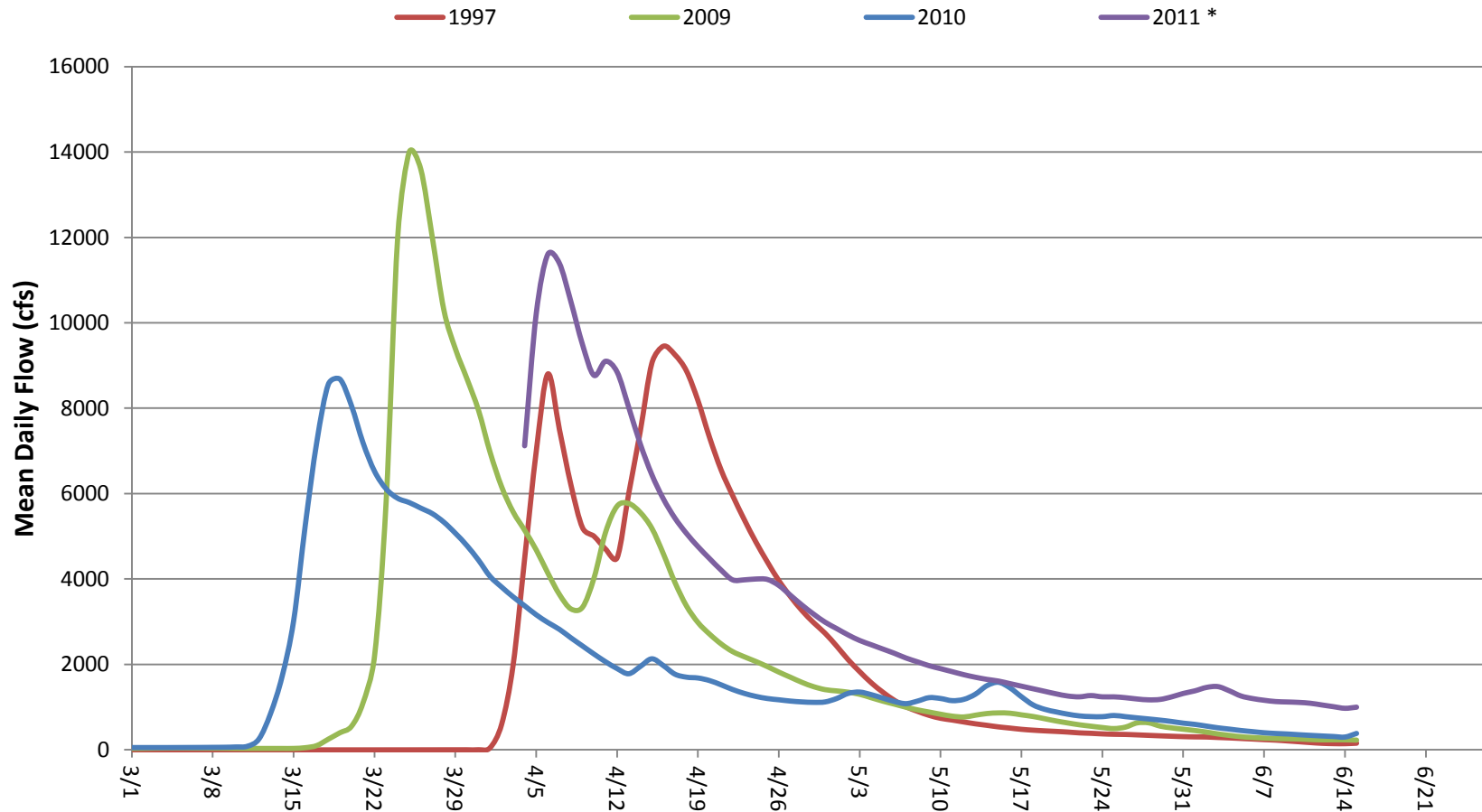
Wild Rice River at Abercrombie

USGS: 05053000



Abercrombie Hydrograph Comparison

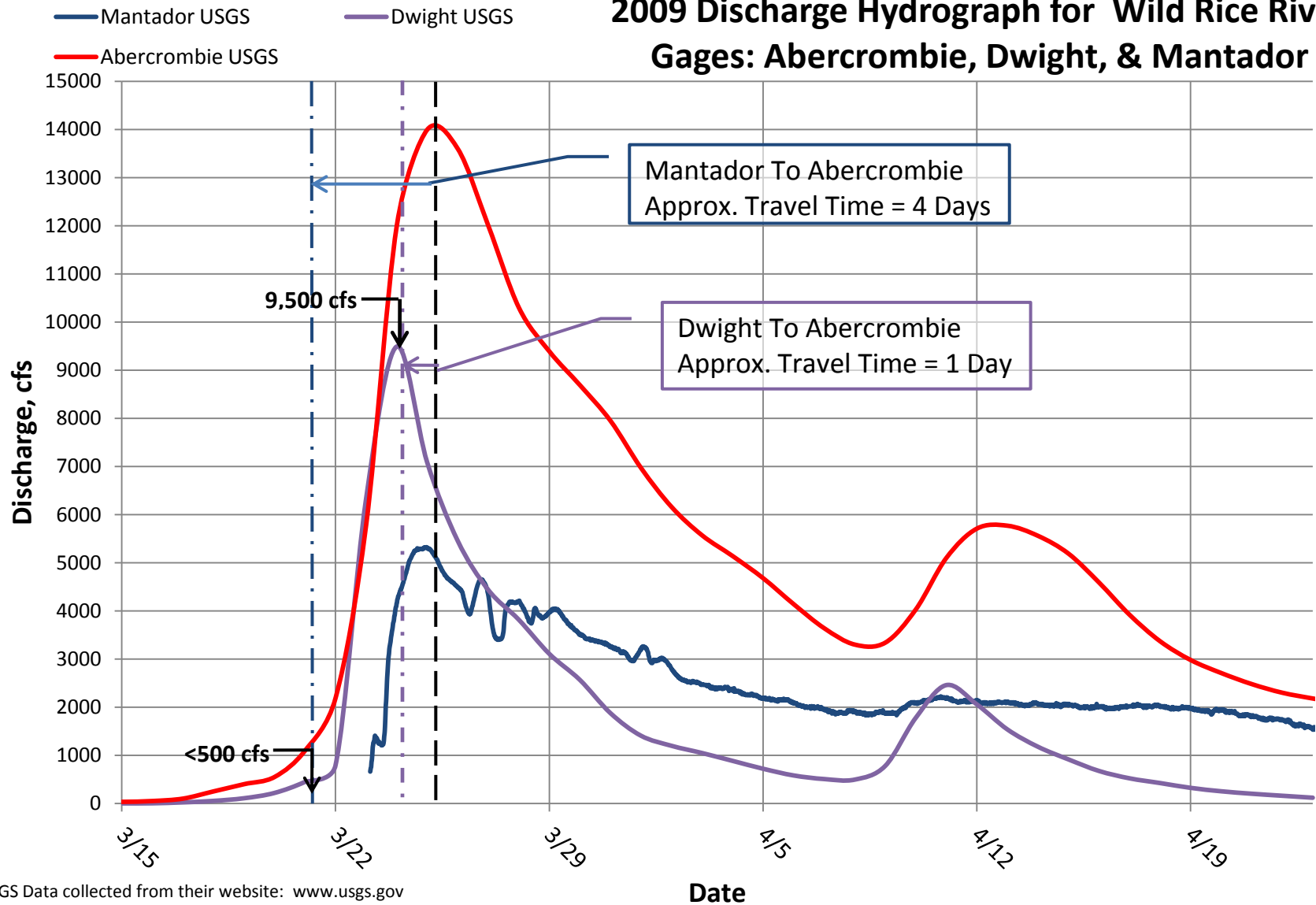
USGS Gage: 05053000



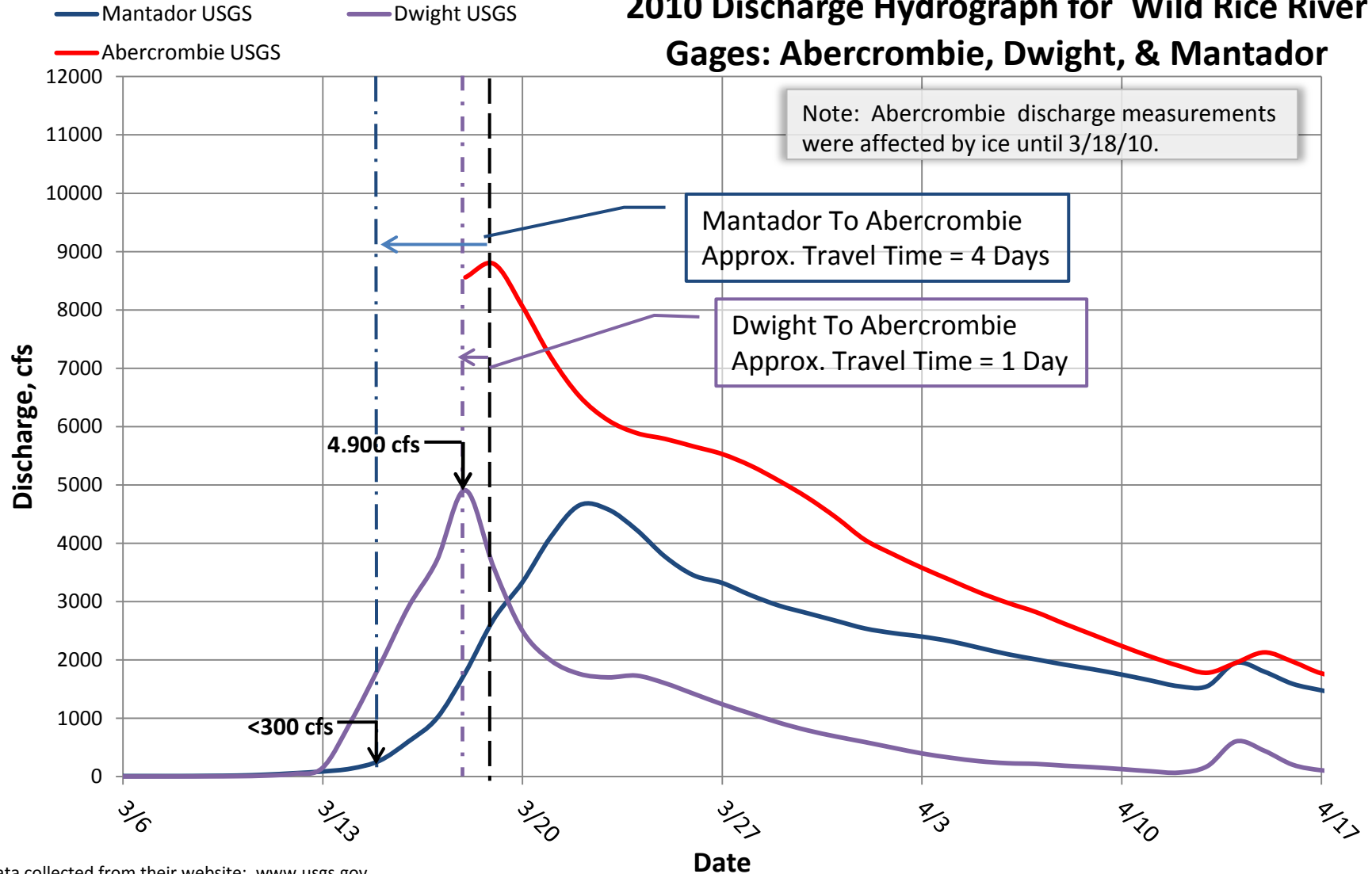
* - 2011 data is provisional

USGS Data collected from their website: www.usgs.gov

2009 Discharge Hydrograph for Wild Rice River Gages: Abercrombie, Dwight, & Mantador

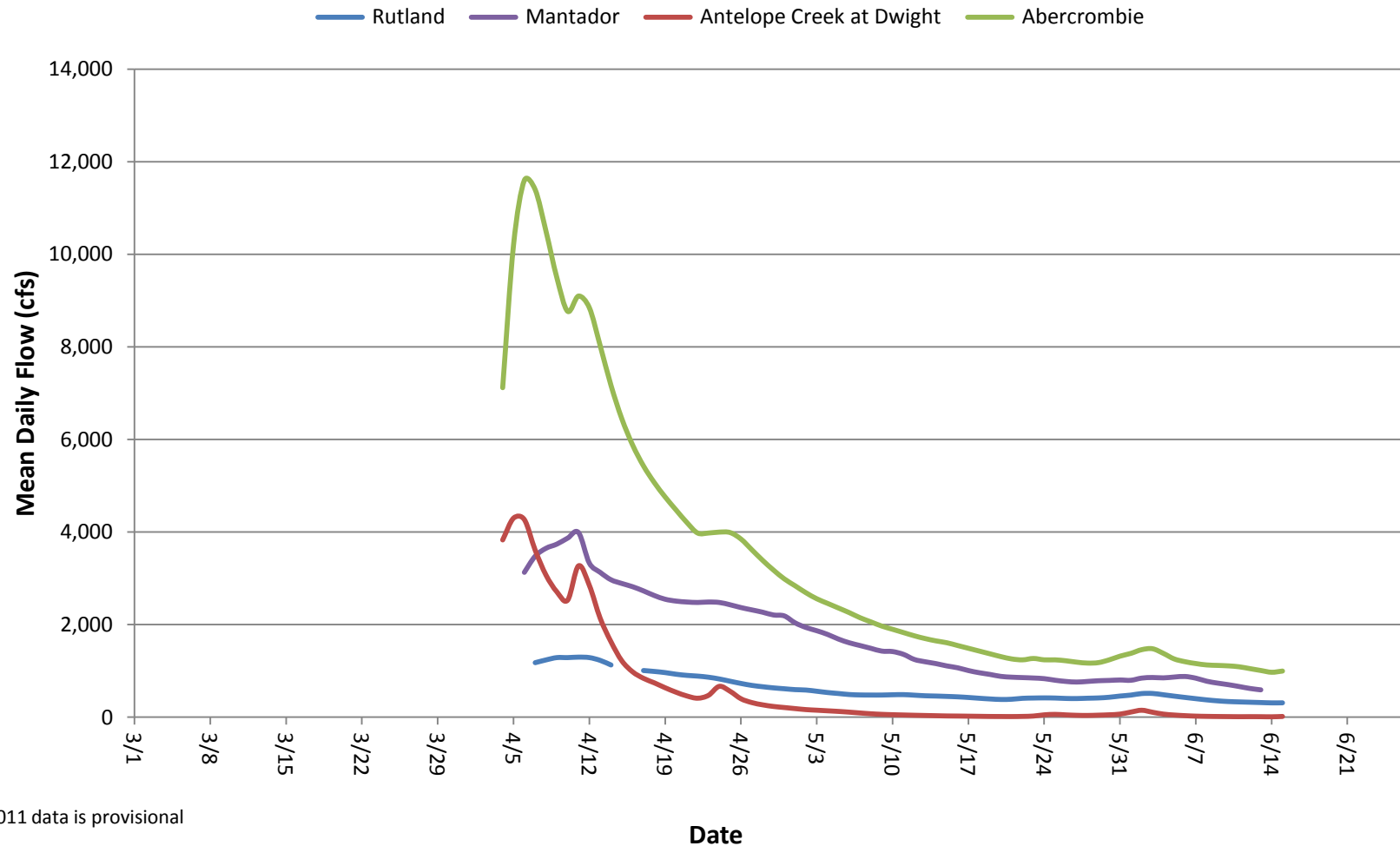


2010 Discharge Hydrograph for Wild Rice River Gages: Abercrombie, Dwight, & Mantador



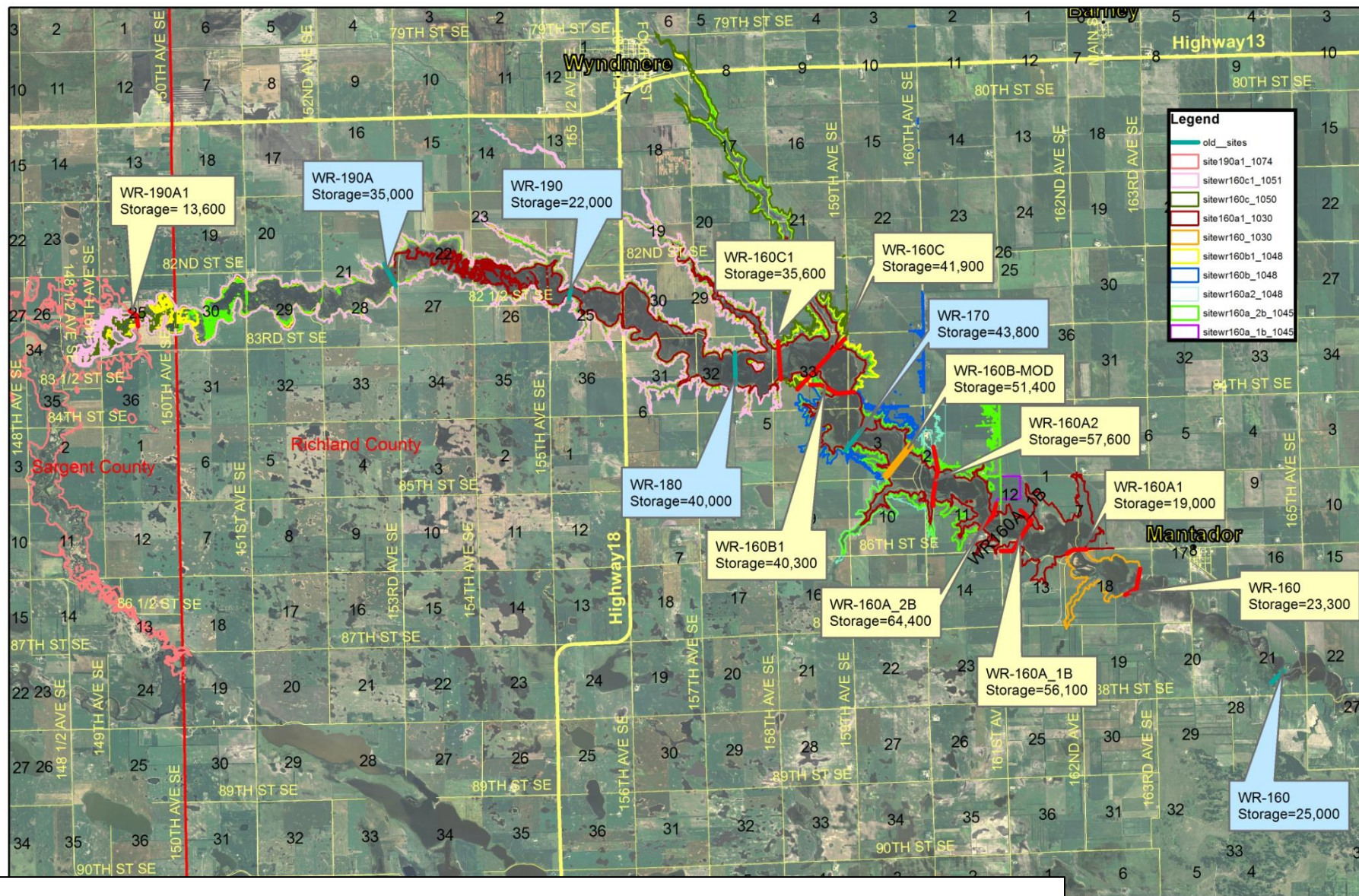
Antelope Creek and Wild Rice River - Spring 2011*

USGS Gages 05052000



* - 2011 data is provisional

USGS Data collected from their website: www.usgs.gov

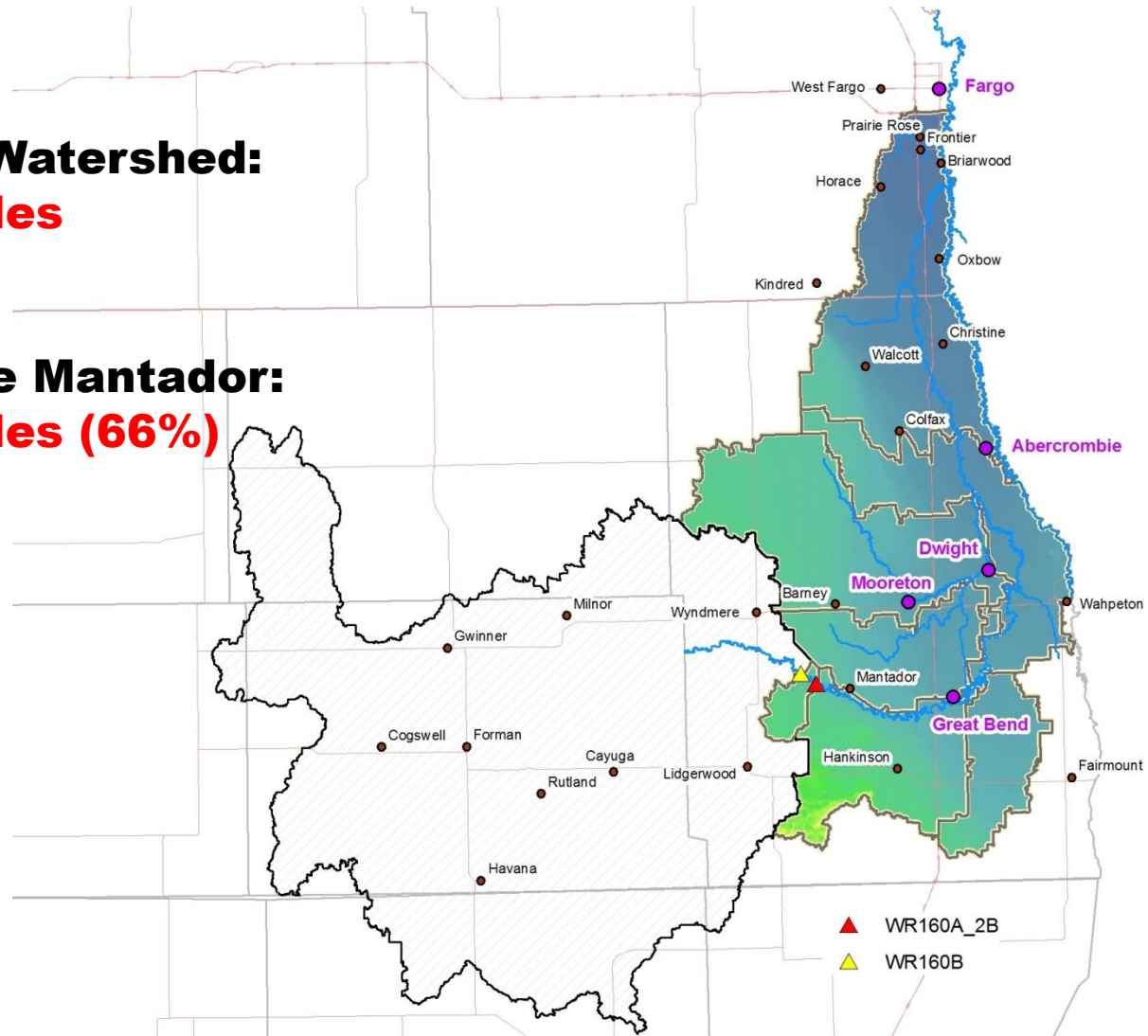


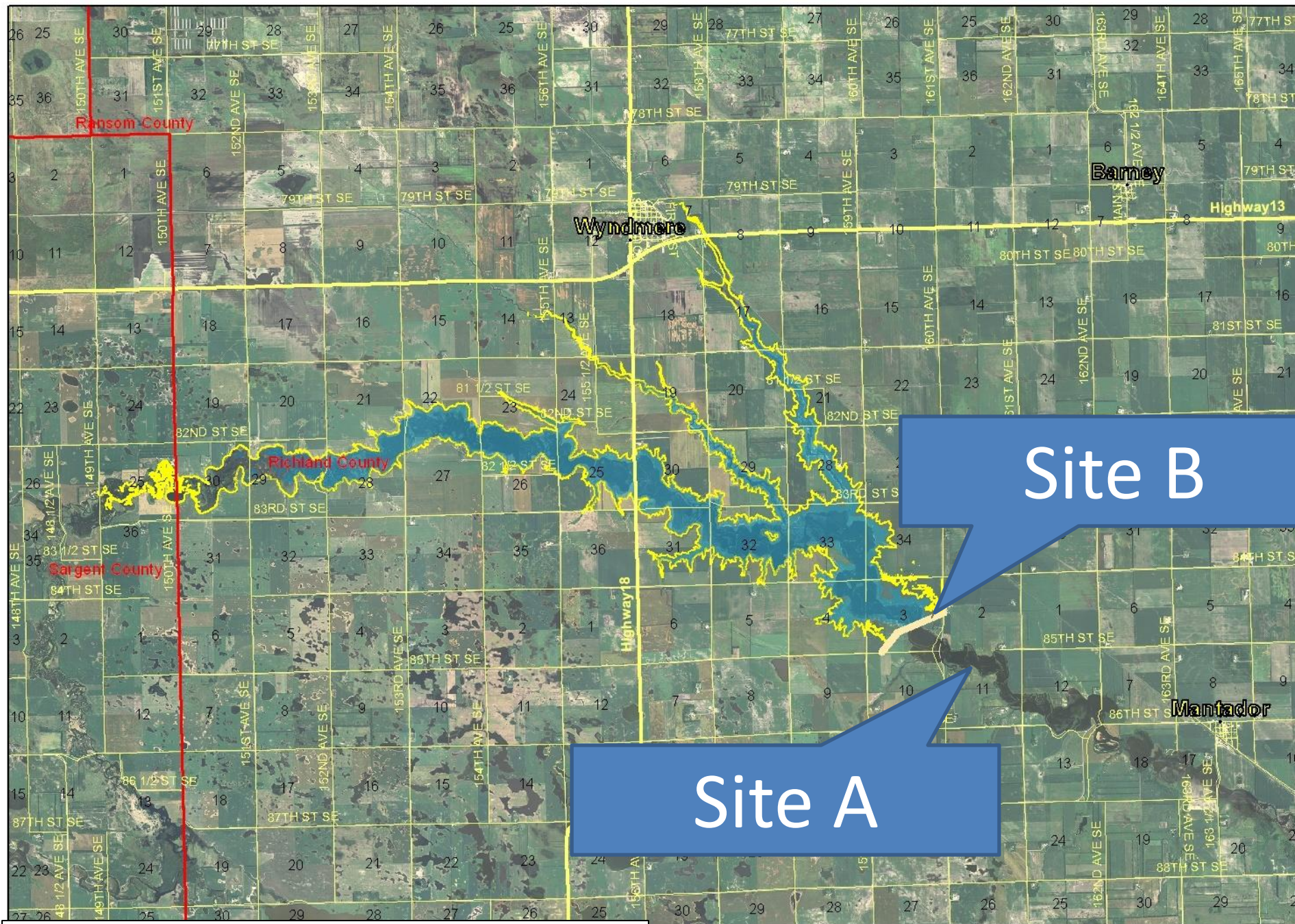
RETENTION SITE STUDY

RETENTION LOCATION SELECTED MANTADOR, ND

Wild Rice River Watershed:
2,350 Square Miles

Watershed above Mantador:
1,540 Square Miles (66%)





Site B

Site A

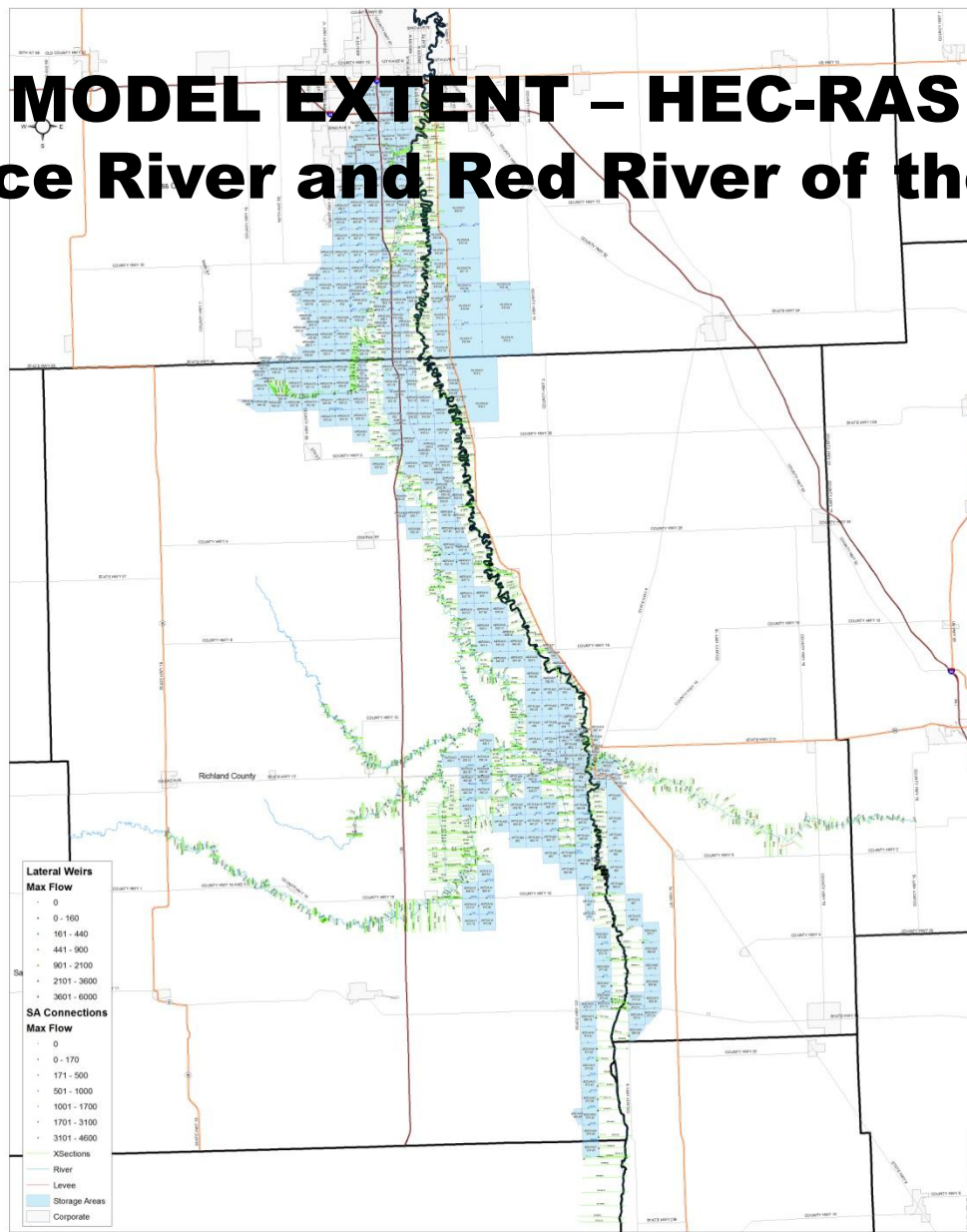
2 Sites Selected for Modeling

N

	Site B	Site A
Location	Section 3 Liberty Grove Twp. Richland Co. ND	Section 11 Liberty Grove Twp. Richland Co. ND
Invert Elevation	1010 ± (NAVD 88)	1009 ± (NAVD 88)
Top Dam Elevation	1048 (NAVD 88)	1048 (NAVD 88)
Dam Height	38' ±	39' ±
Easement Area	4,400± Acre	5,500 ± Acre
Secondary Spillway Elevation	1036.0 (NAVD 88)	1036.5 (NAVD 88)
Secondary Spillway Height	26 ±	27.5' ±
Secondary Spillway Volume	29,800 Ac-ft (0.48 inches)	40,000 Ac-ft (0.65 inches)
Water Surface Area	2,600± Acres (4 Square Miles)	3,100 ± Acres
Emergency Spillway Elevation	1043 (NAVD 88)	1043 (NAVD 88)
Emergency Spillway Height	33' ±	34.5' ±
Emergency Spillway Volume	51,400 Ac-ft (0.83 inches)	64,400 Ac-ft (1.04 inches)
Water Surface Area		
Primary Spillway Dimensions	15'x10' RCB	15'x10' RCB
Secondary Spillway Dimensions	210' Concrete	195' Concrete
Emergency Spillway Dimensions	1,650' Earth	1,750' Earth

MODEL EXTENT – HEC-RAS

Wild Rice River and Red River of the North



HISTORICAL 1997 FLOOD EVENT
WILD RICE DAM STUDY

Lateral Weirs & SA Connections Max Flow
Storage Area & Cross Section Max Elevation

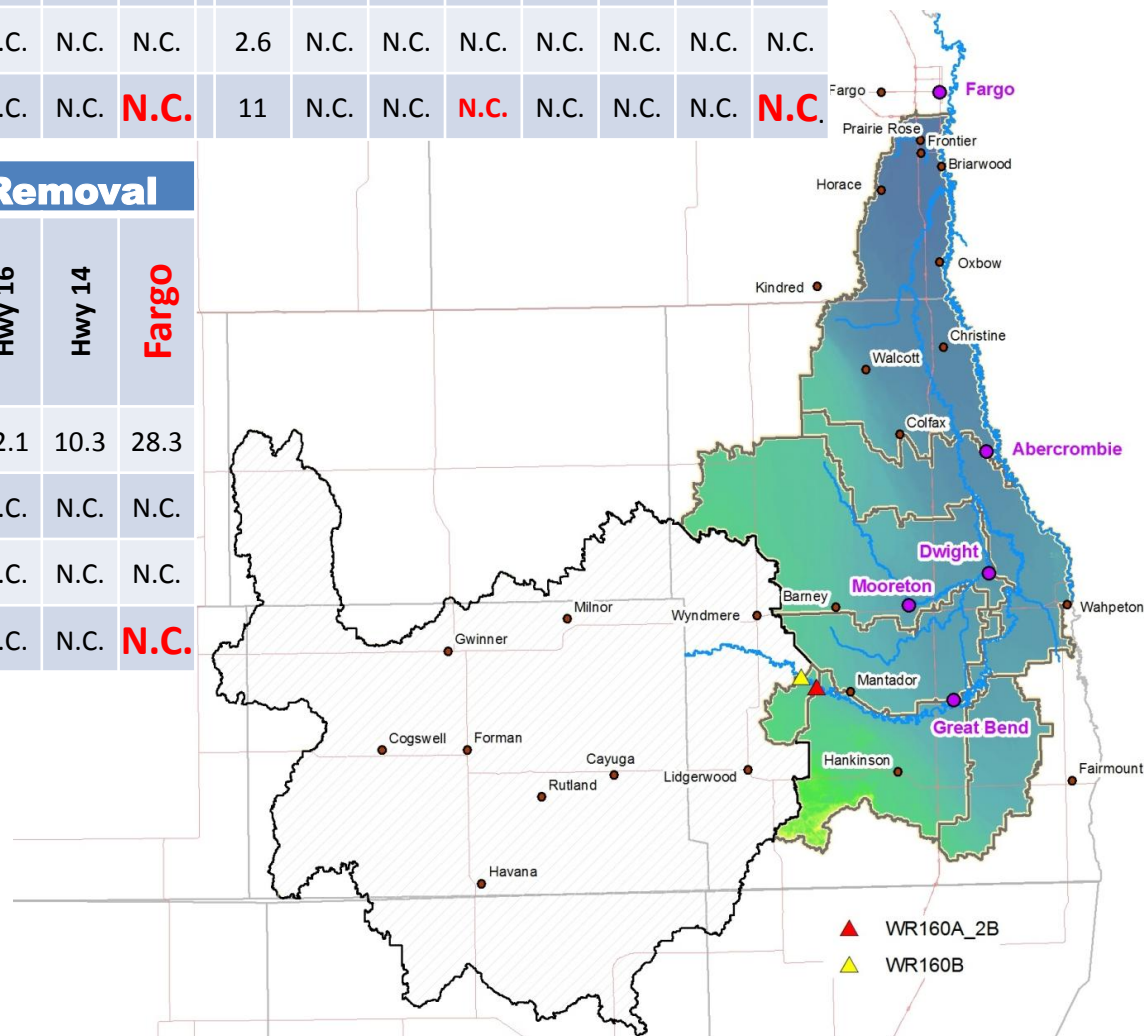
0 5 10 20 Miles

Historic 2009

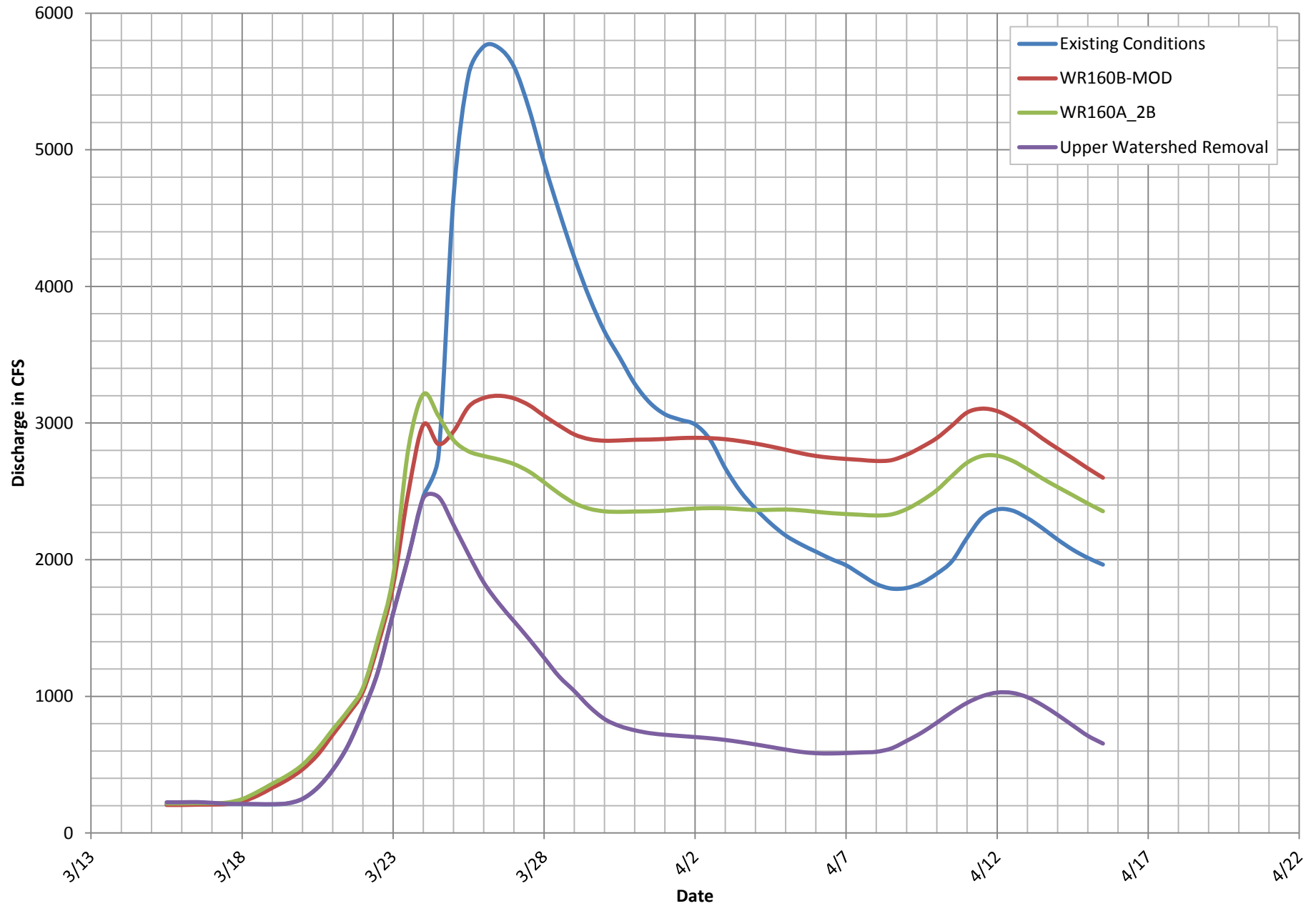
	SITE B								SITE A							
	Great Bend	Mooreton	Dwight	Abercrombie	Hwy 2	Hwy 16	Hwy 14	Fargo	Great Bend	Mooreton	Dwight	Abercrombie	Hwy 2	Hwy 16	Hwy 14	Fargo
Peak Q (kcfs) - Existing	5.8	3.8	9.0	13.7	14.8	12.1	10.3	28.3	5.8	3.8	9.0	13.7	14.8	12.1	10.3	28.3
Peak Q (kcfs) - Project	3.2	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	3.2	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Q (kcfs) - Change	2.6	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	2.6	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Stage (Inches) - Diff	11	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	11	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

	Upper Watershed Removal							
	Great Bend	Mooreton	Dwight	Abercrombie	Hwy 2	Hwy 16	Hwy 14	Fargo
Peak Q (kcfs) - Existing	5.8	3.8	9.0	13.7	14.8	12.1	10.3	28.3
Peak Q (kcfs) - Project	2.5	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Q (kcfs) - Change	3.3	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Stage (Inches) - Diff	18	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

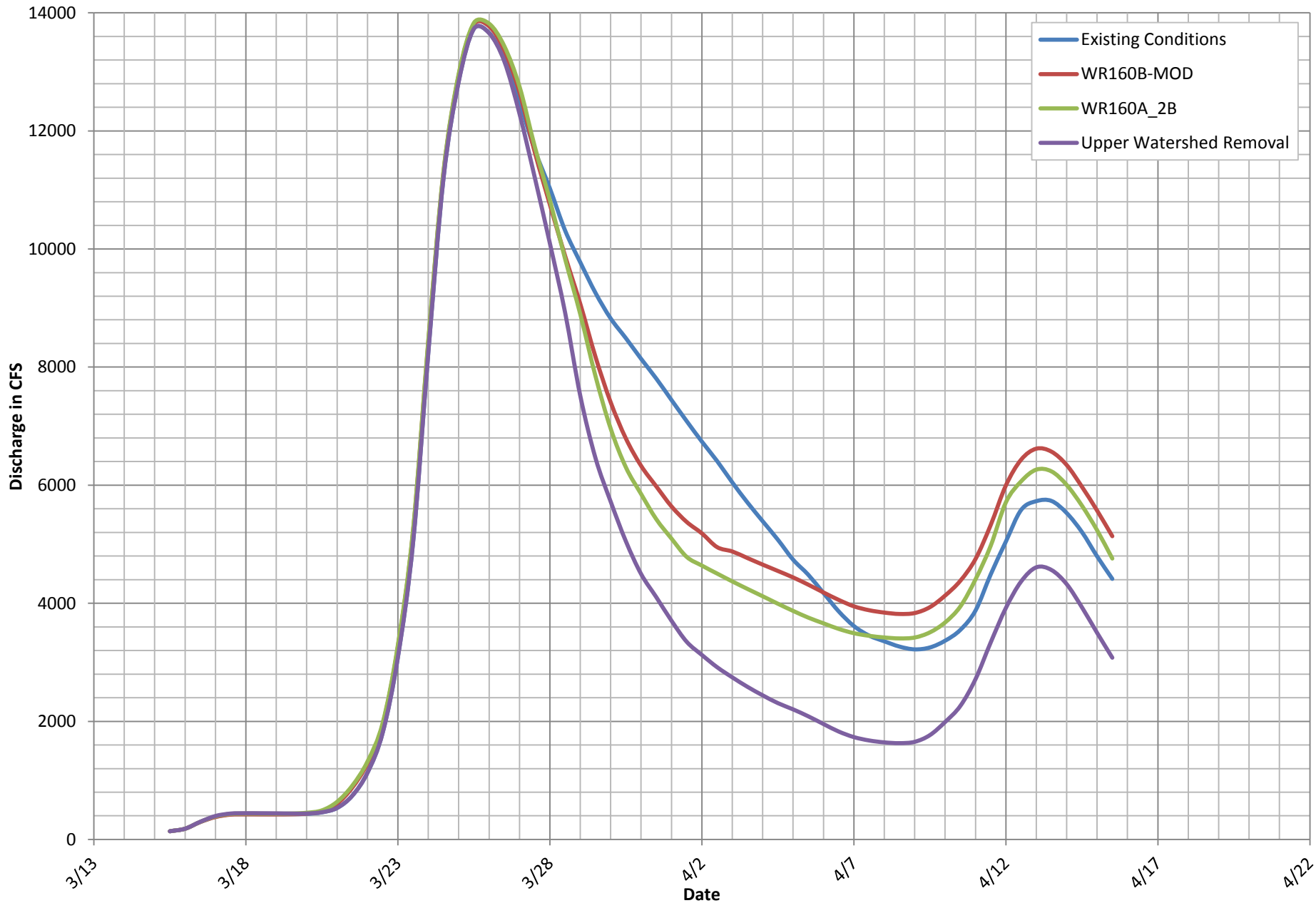
N.C.= change in discharge is less than 100 cfs
or change in stage is less than 1 inch



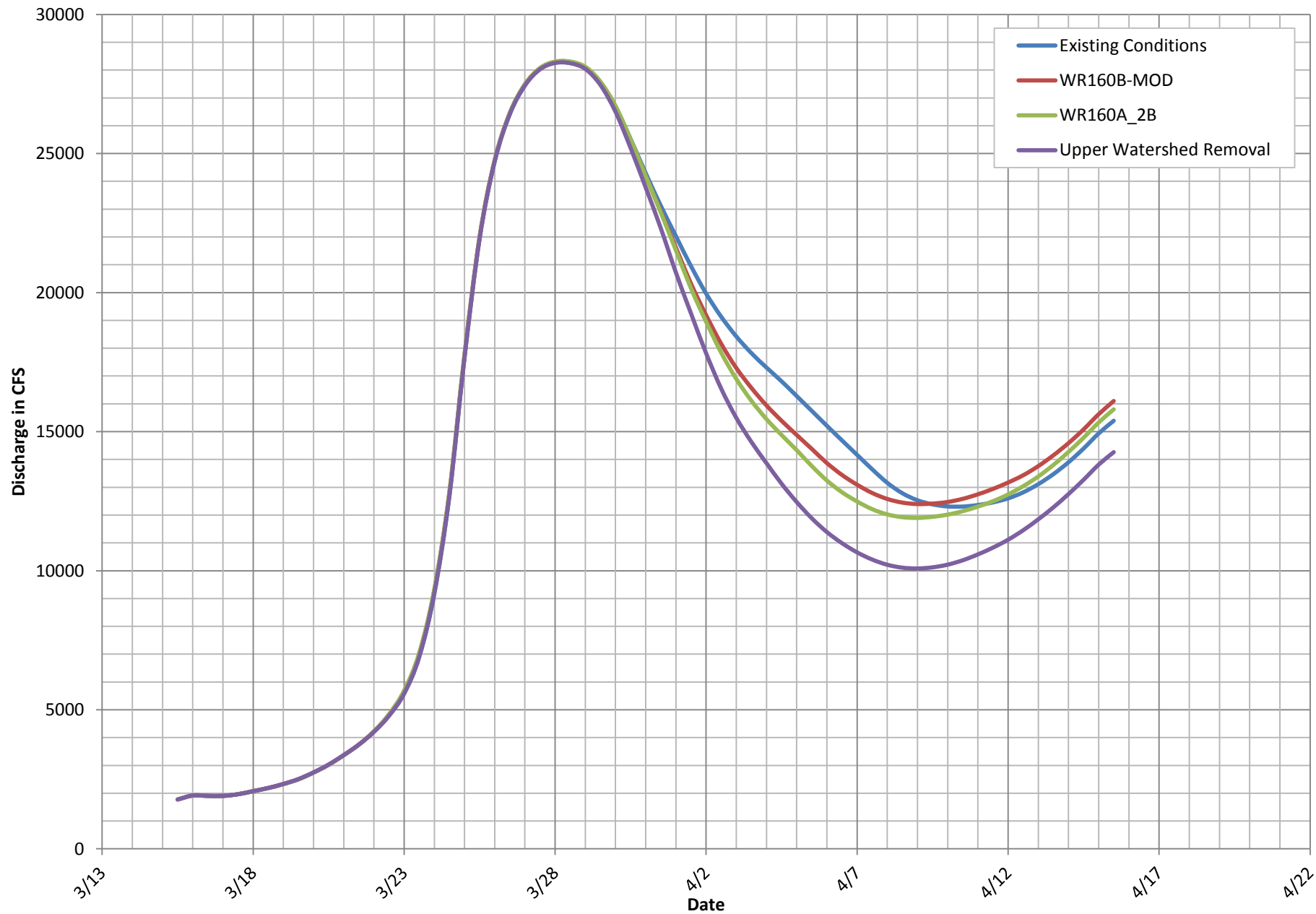
2009 Wild Rice River at Great Bend, ND Discharge Hydrograph



2009 Wild Rice River at Abercrombie, ND Discharge Hydrograph



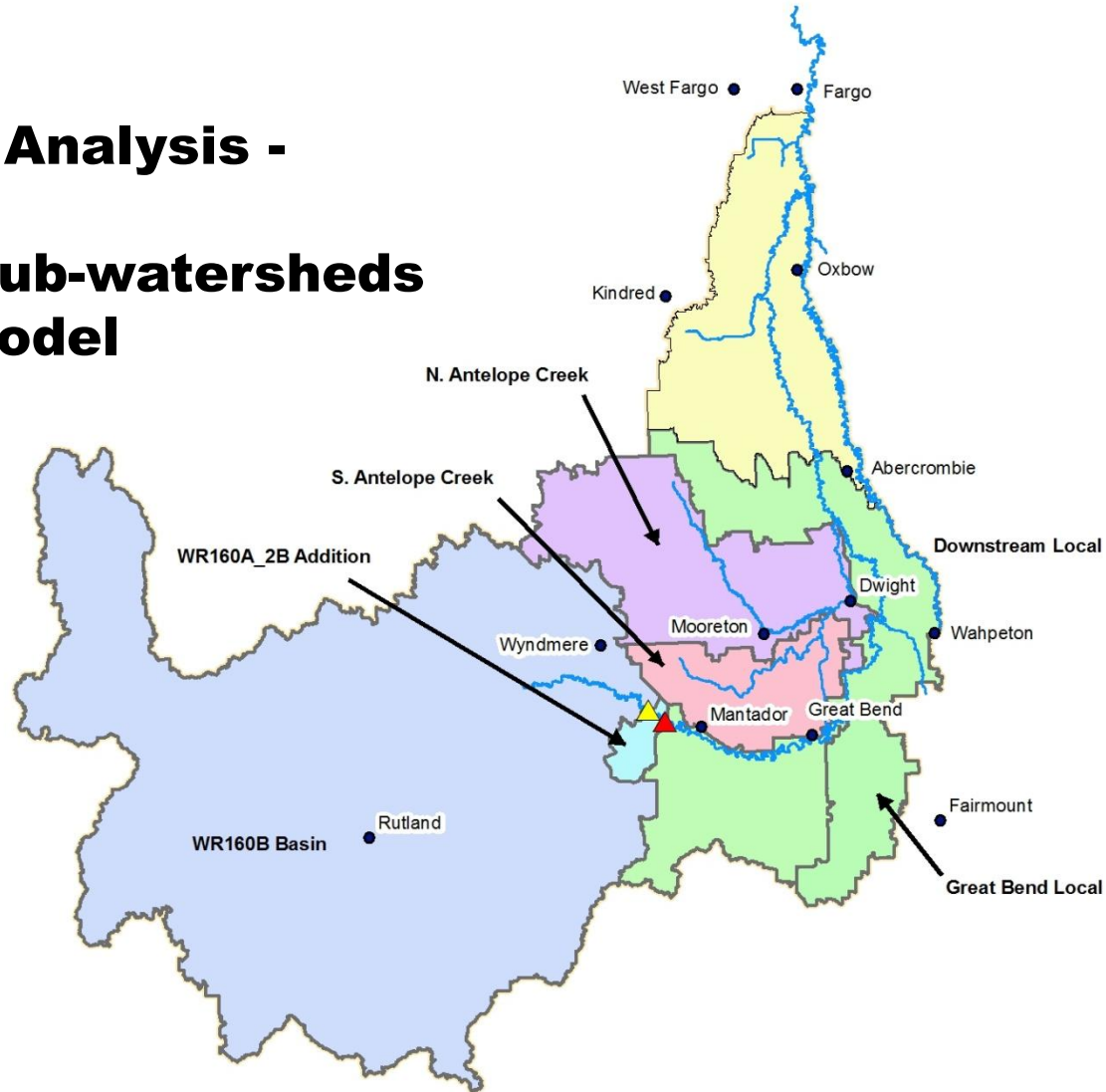
2009 Red River at Fargo, ND Discharge Hydrograph



2009 HEC-RAS MODELING

Sensitivity Analysis -

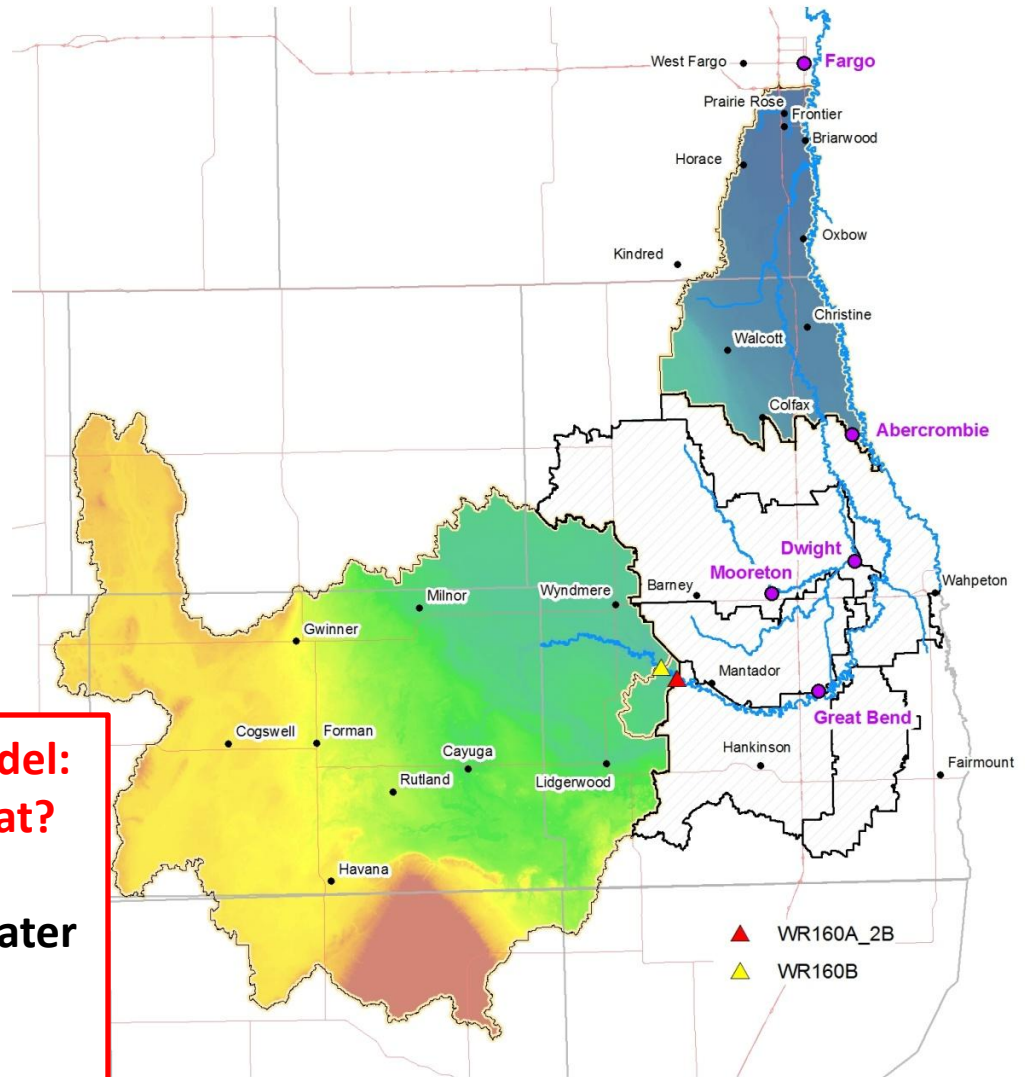
**removing sub-watersheds
from the model**



2009 FLOOD SENSITIVITY ANALYSIS

2009 FARGO ANALYSIS:

Scenario	CFS	FEET
Fargo Existing:	28,300	40.6
Upper Removal:	28,300	40.6
Mid Removal:	26,200	39.7
Lower Removal:	27,200	40.1
Entire Removal:	22,300	37.8
2010 Actual	21,200	37.0



**Entire Removal of Wild Rice from the Model:
300,000 AC-FT of Water...How much is that?**

1 Township (36 Sections) = 13.0' of Water
2 Townships (72 Sections) = 6.5'
5 Townships (180 Sections) = 2.5'
13 Townships (468 Sections) = 1.0'

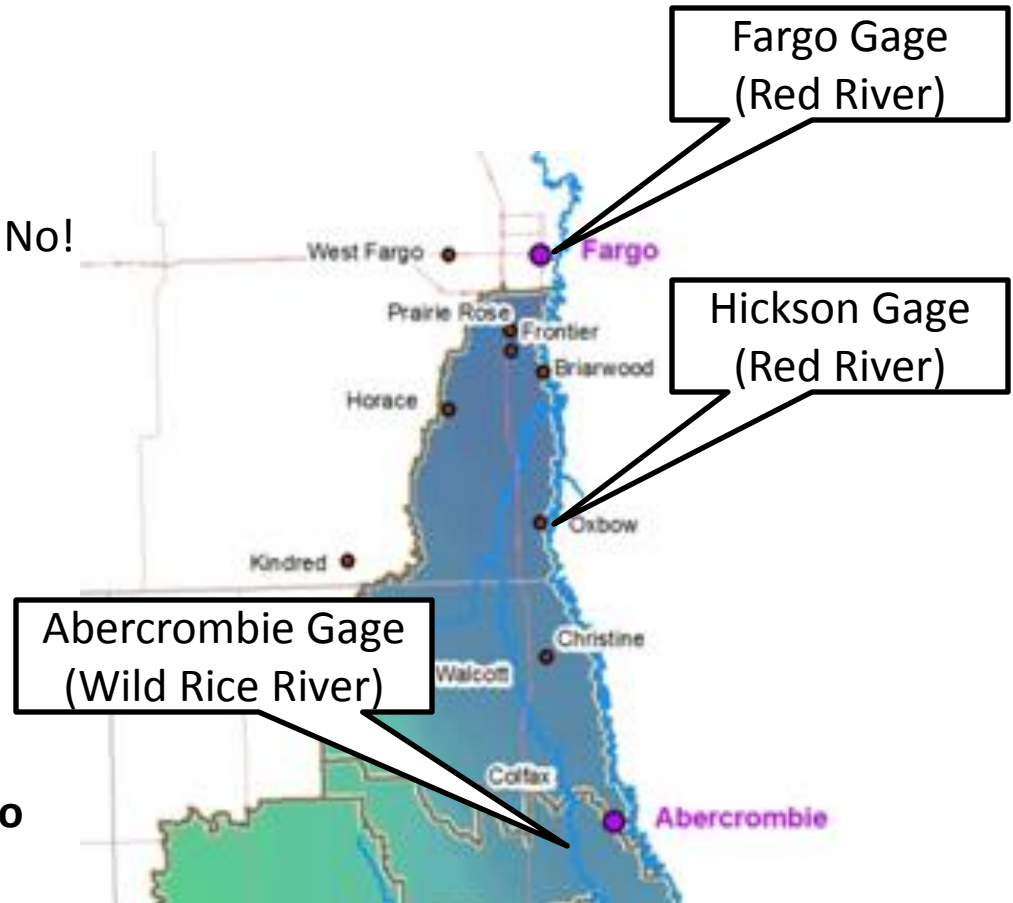
2009 Flood Flows

Wild Rice @ Abercrombie	14,100 cfs
<u>Red River @ Hickson</u>	<u>23,700 cfs</u>
Combined Flow at Fargo???	37,800 cfs No!

Actual Flow at Fargo 29,500 cfs

WHY?

Natural storage (ponding) south of Fargo reduced the flood peak.



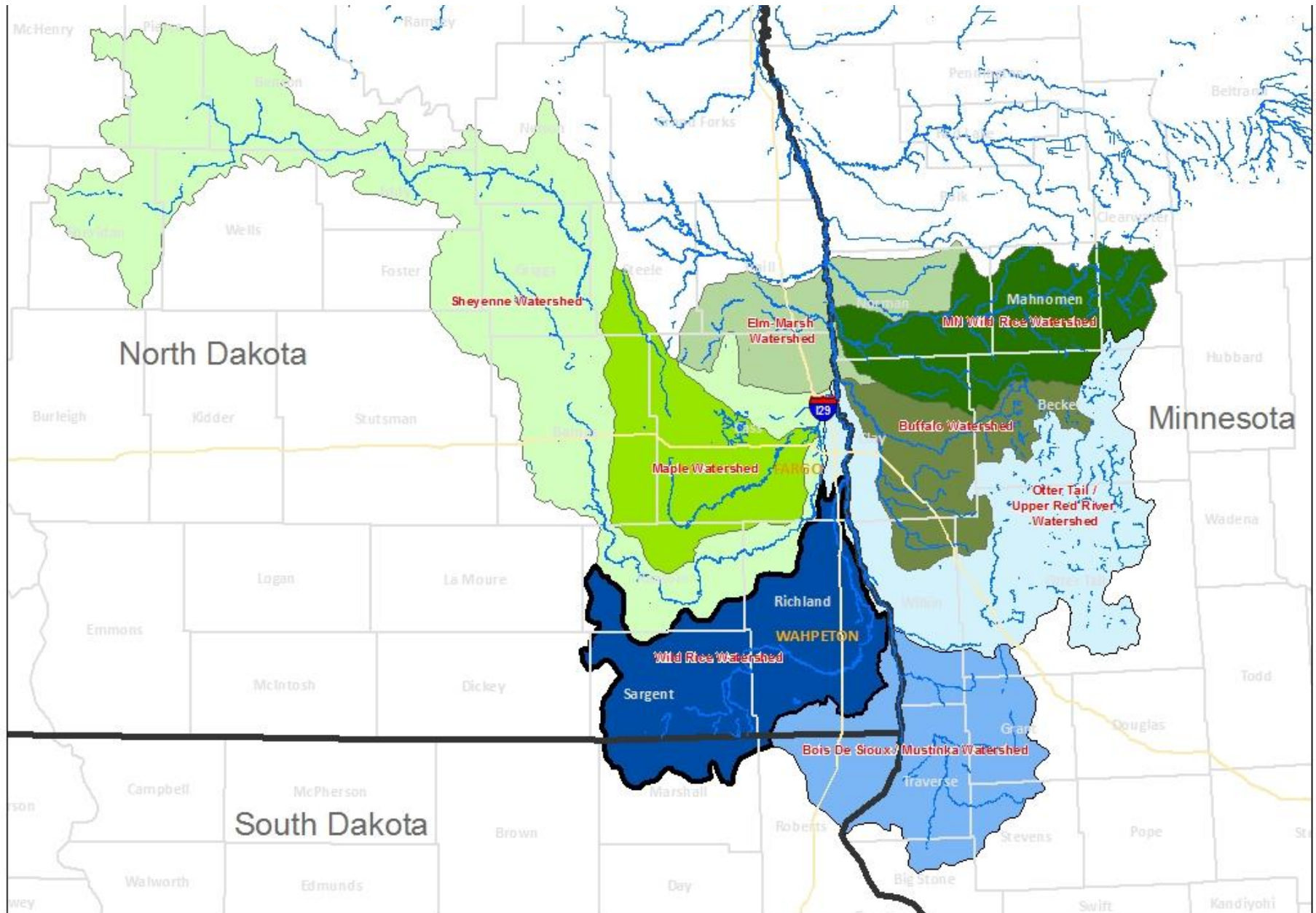
Flow Reduction Goal - Analysis

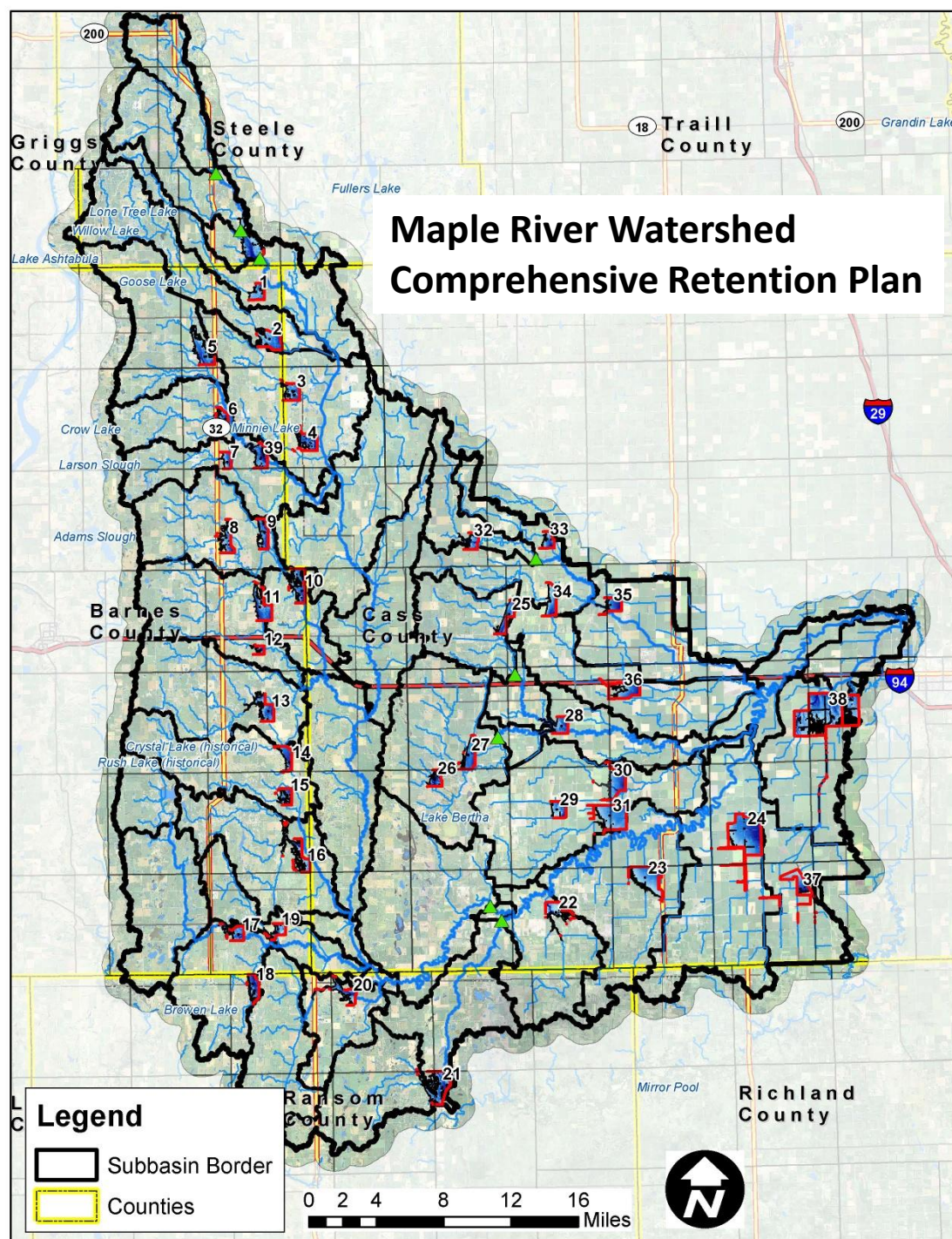
EVENT	NOTE	PEAK DISCHARGE CFS	EXISTING PEAK STAGE FT	20% FLOW REDUCTION DISCHARGE CFS	20% FLOW REDUCTION PEAK STAGE FT	STAGE DIFFERENCE FT
500YR	1	61,700	46.69	49,360	45.06	1.6
200YR	1	46,200	44.57	36,960	42.96	1.6
100YR	1	34,700	42.42	27,760	40.36	2.1
50YR	1	29,300	41.01	23,440	38.46	2.5
2009	2	29,500	40.84	-	-	-
1997	2	28,000	39.57	-	-	-

Note 1: No Protection Stage

Note 2: With Protection Stage

Comprehensive Watershed Retention Plans





CONCLUSIONS

- The historic record of Wild Rice floods shows a repeating pattern of similarity. This includes 2009, 2010, and 2011. There is 1 exception.
- 1997 flood is significantly different; it is not typical.
- Modeling shows the Upper Wild Rice Watershed does not contribute to the Red River crest at Fargo. Timing!
- Wild Rice Retention modeling shows strong potential for local benefits within the Wild Rice Watershed.
- Wild Rice Retention modeling shows diminished benefit to the Red River at Fargo.