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Shaping the Region for 50 Years.

ND Detention Project Development Update

Consulting Engineering • Land Surveying

West Fargo, ND • Fergus Falls, MN

Upper Red River Basin

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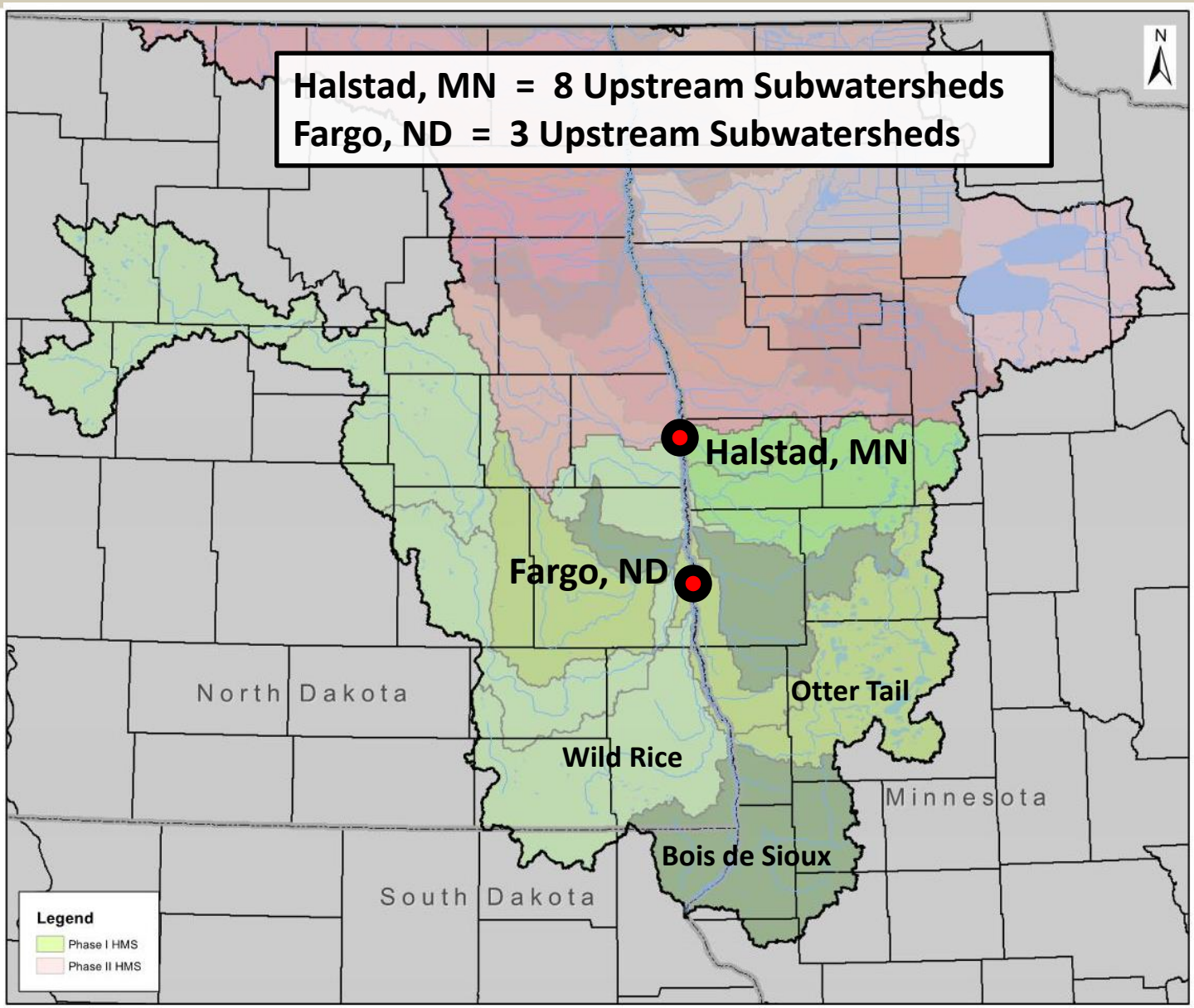

Upstream of F/M

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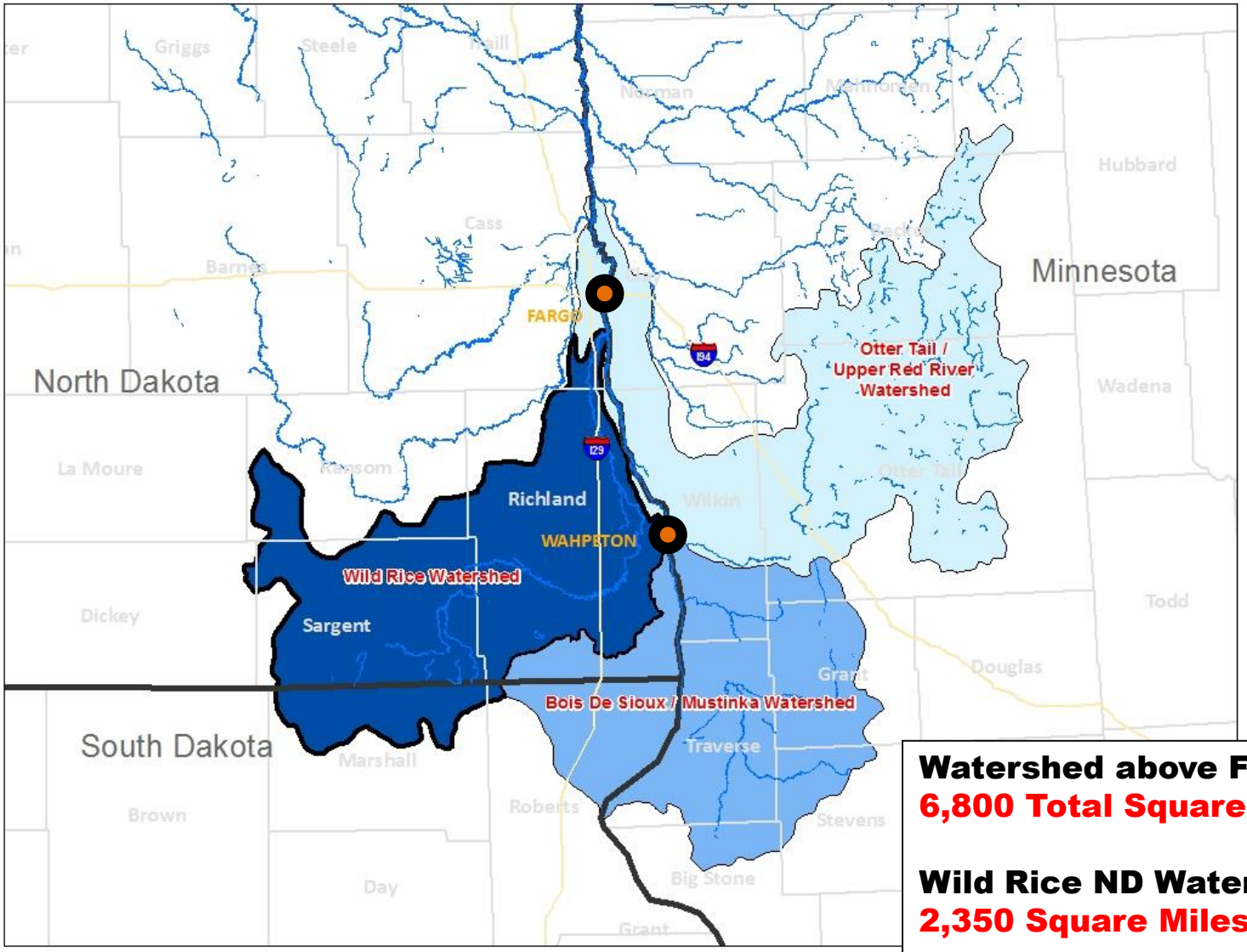

Watershed above F/M:
6,800 Total Square Miles

Wild Rice ND Watershed:
2,350 Square Miles (35%)

Watershed Timing

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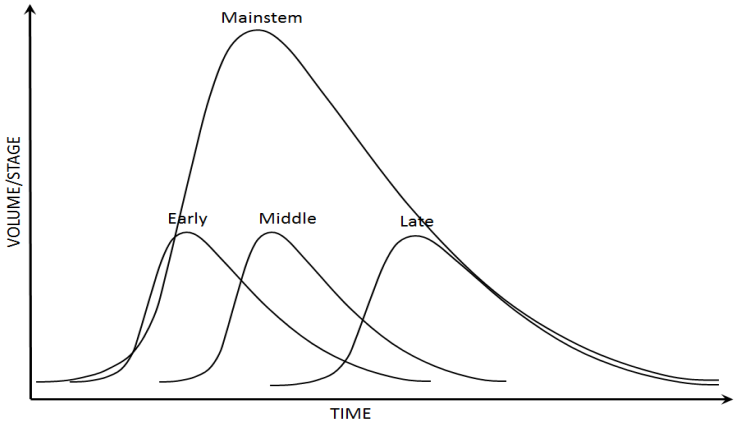
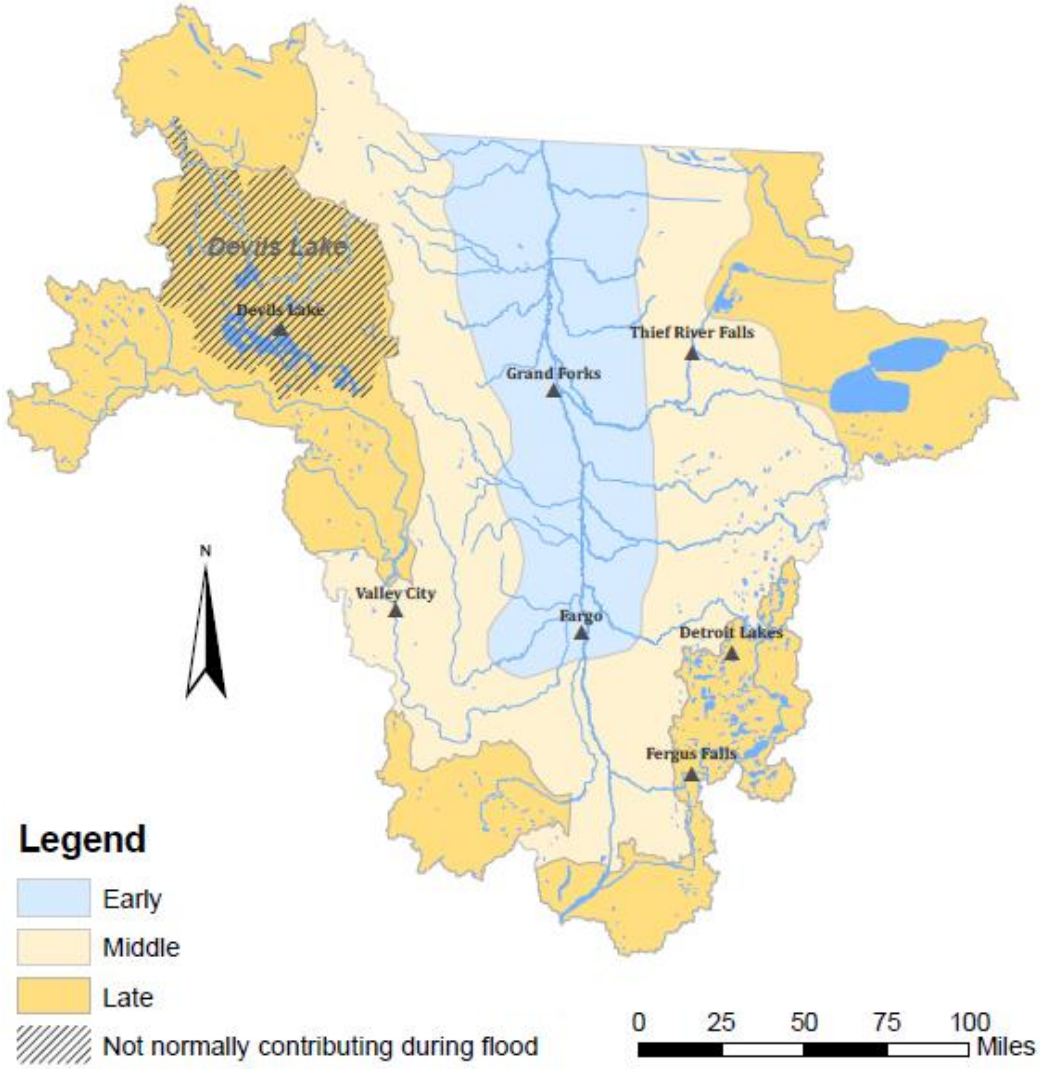
Early-Middle-Late Concept





Projects Constructed

- ND WRD Sponsored Projects in the RR Watershed

– 1967, Clausen Springs Dam, Sheyenne River, Barnes County	350 Ac-Ft
– 1970, Erie Dam (Brewer Lake), Rush River, Cass County	300 Ac-Ft
– 1984, Dead Colt Creek Dam, Sheyenne River, Ransom County	4,900 Ac-Ft
– 1985, T-180 Dam, Maple River, Cass County	2,900 Ac-Ft
– 1988, Beaver Creek Dam, Goose River, Steele County	5,350 Ac-Ft
– 2004, Baldhill Dam Raise, Sheyenne River, Barnes County	30,800 Ac-Ft
– 2006, Maple River Dam, Maple River, Cass County	60,000 Ac-Ft
– 2015, Upper Maple River Dam, Maple River, Steele County	5,400 Ac-Ft
– **Total Flood Storage Volume Constructed (8 Projects)**	**110,000 Ac-Ft**

Upper Maple River Dam

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Recent Studies

- **Comprehensive Watershed Detention Studies**
  - Completed for Red River tributary watersheds
  - Used to develop the RRBC HUR Study (20% flow reduction analysis)

- **Wild Rice Mainstem Dam @ Mantador, ND (Late Water)**
  - Hydrologic/Hydraulic modeling completed
  - Geotech, preliminary design, and cost estimate completed
  - Preliminary results showed limited F/M benefit – late water
  - Feasibility concerns
  - Project development is inactive

- **Bois de Sioux State-Line Dam (Late Water)**
  - Hydrologic/Hydraulic modeling completed
  - Preliminary results showed limited F/M benefit – late water
  - Feasibility concerns
  - Project development is inactive

Future Studies/Projects

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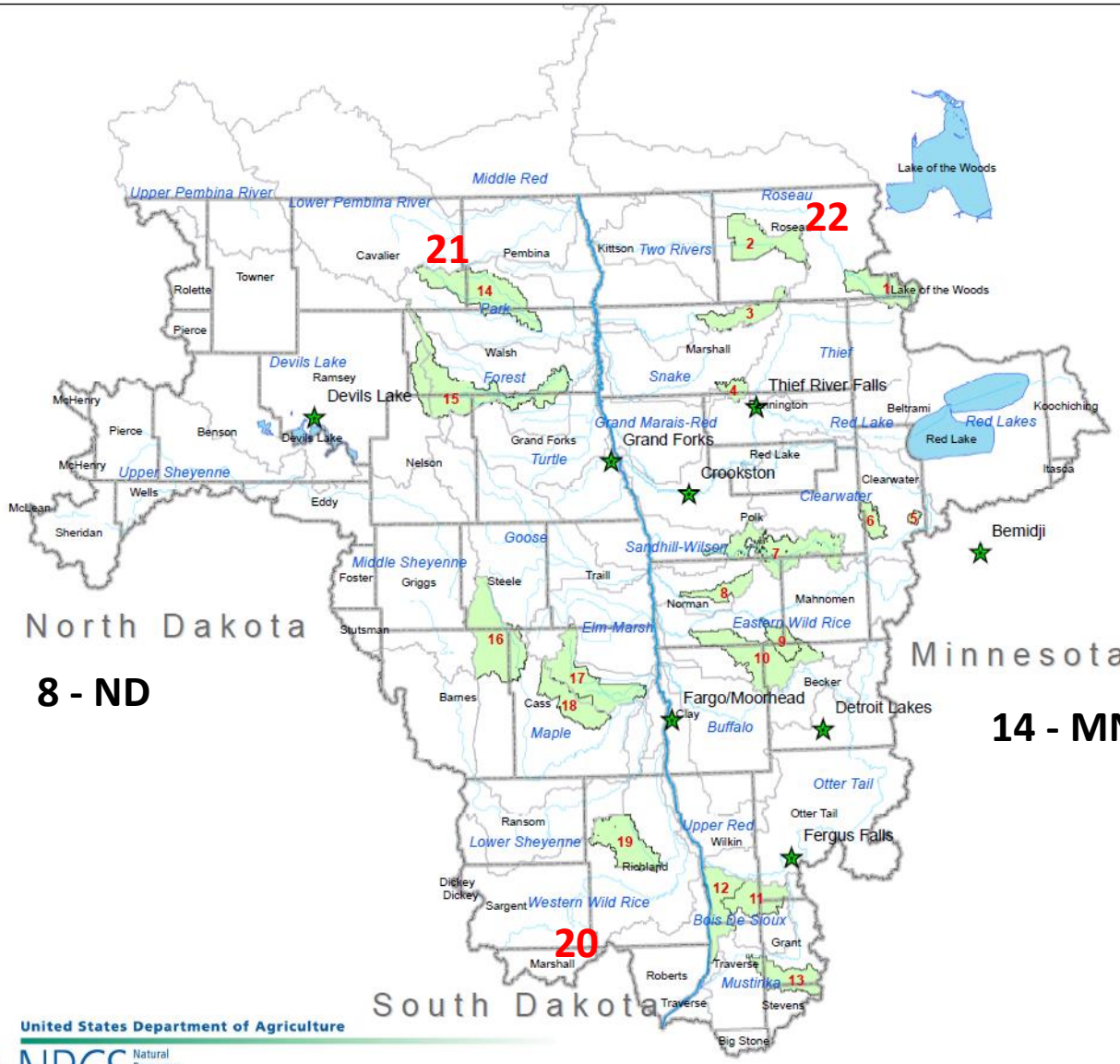

8 - ND

14 - MN

Red River Basin of the North RCPP Watershed Project Areas

ID	Name
1	Beltrami Island State Forest
2	Klondike
3	Middle-Snake-Tamarac JD-19
4	Middle-Snake-Tamarac JD-14
5	Four Legged Lake
6	Pine Lake
7	Upper Sandhill River
8	Green Meadow
9	Maccasin Creek
10	South Branch Wild Rice River
11	Rabbit River
12	Bois De Sioux Direct
13	Five Mile Creek
14	North Branch Park River
15	Forest River
16	Upper Maple River
17	Rush River
18	Swan Creek
19	North Branch Antelope Creek

20 Shortfoot Creek
21 Upper Tongue River
22 Whitney Lake

1 in = 30 miles

0 15 30 60 90 120 Miles

United States Department of Agriculture
NRCS Natural Resources Conservation Service

The End

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Questions?

Bois de Sioux State Line Dam?

Bois de Sioux State Line Dam

Bois de Sioux Watershed

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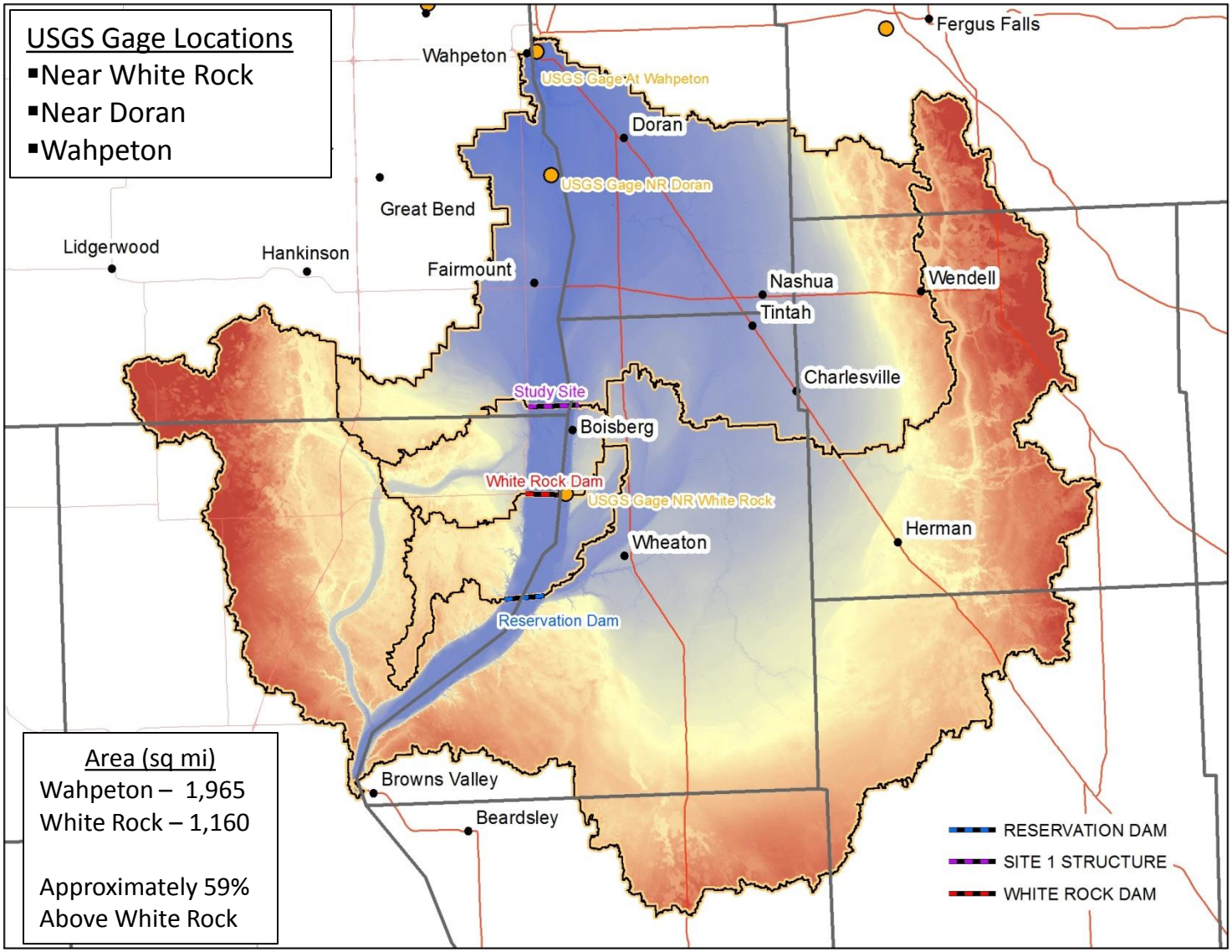

Travel Time of Peak

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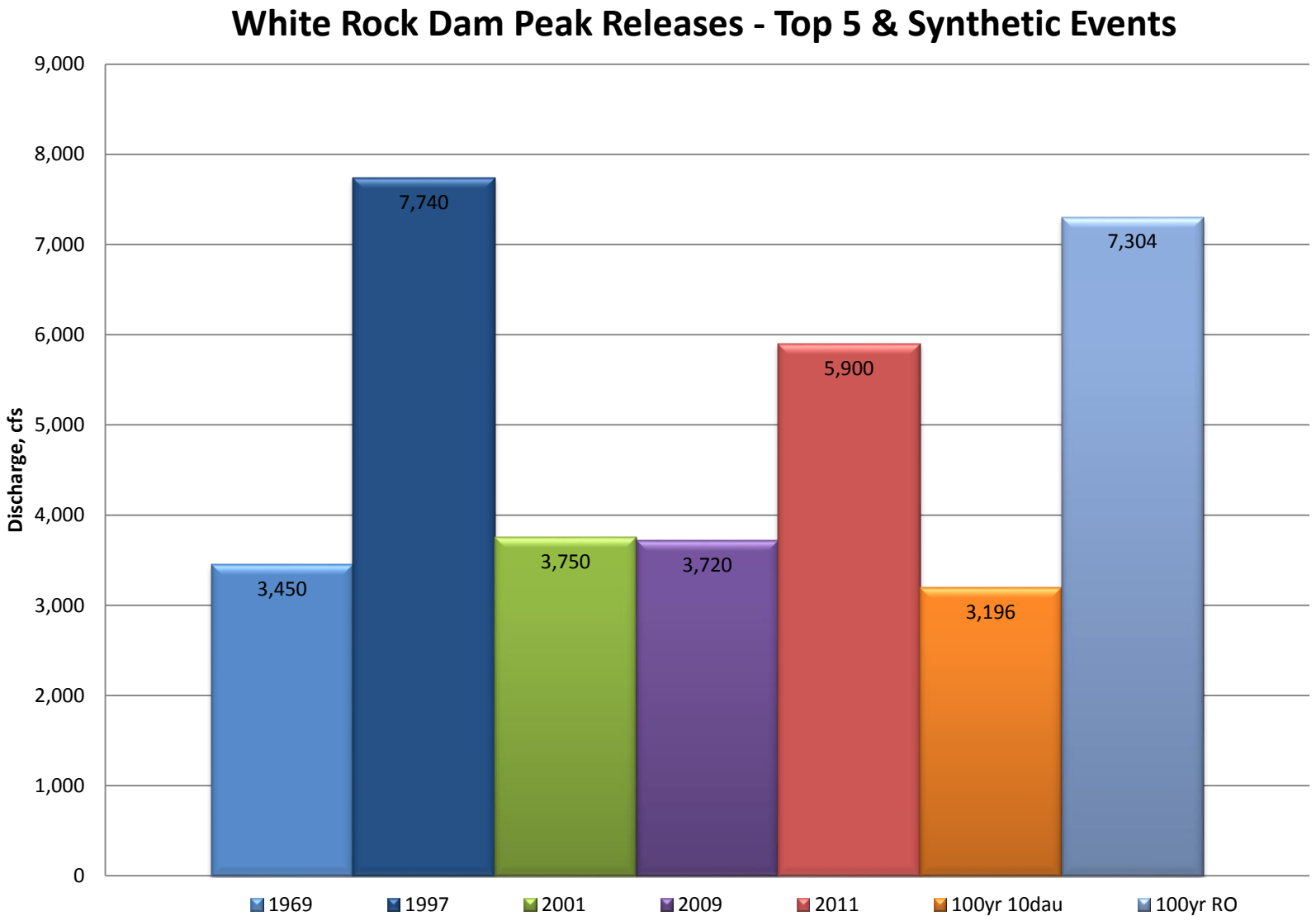
Travel time from Lake Traverse to Fargo (10 day Avg.)

	1997	2009	100-year Rainfall	100-year Runoff
Lake Traverse to Rabbit River	6.0	3.0	4.0	4.5
Rabbit River to Wahpeton	3.0	2.5	1.5	5.5
Wahpeton to Fargo	3.0	3.0	3.0	3.5
Total (day)	12.0	8.5	8.5	13.5

White Rock Peak Releases



Lake Traverse Pool El.

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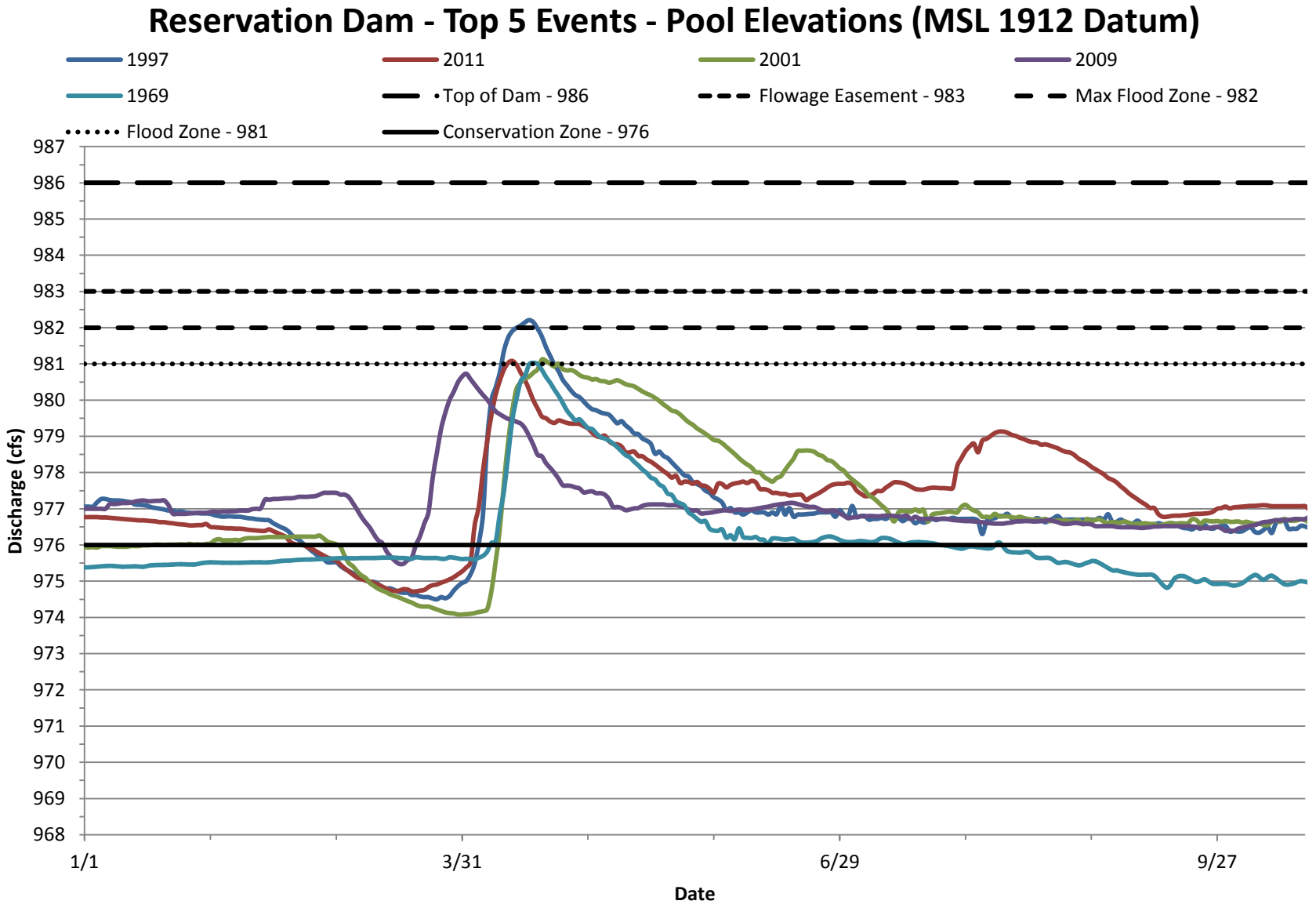
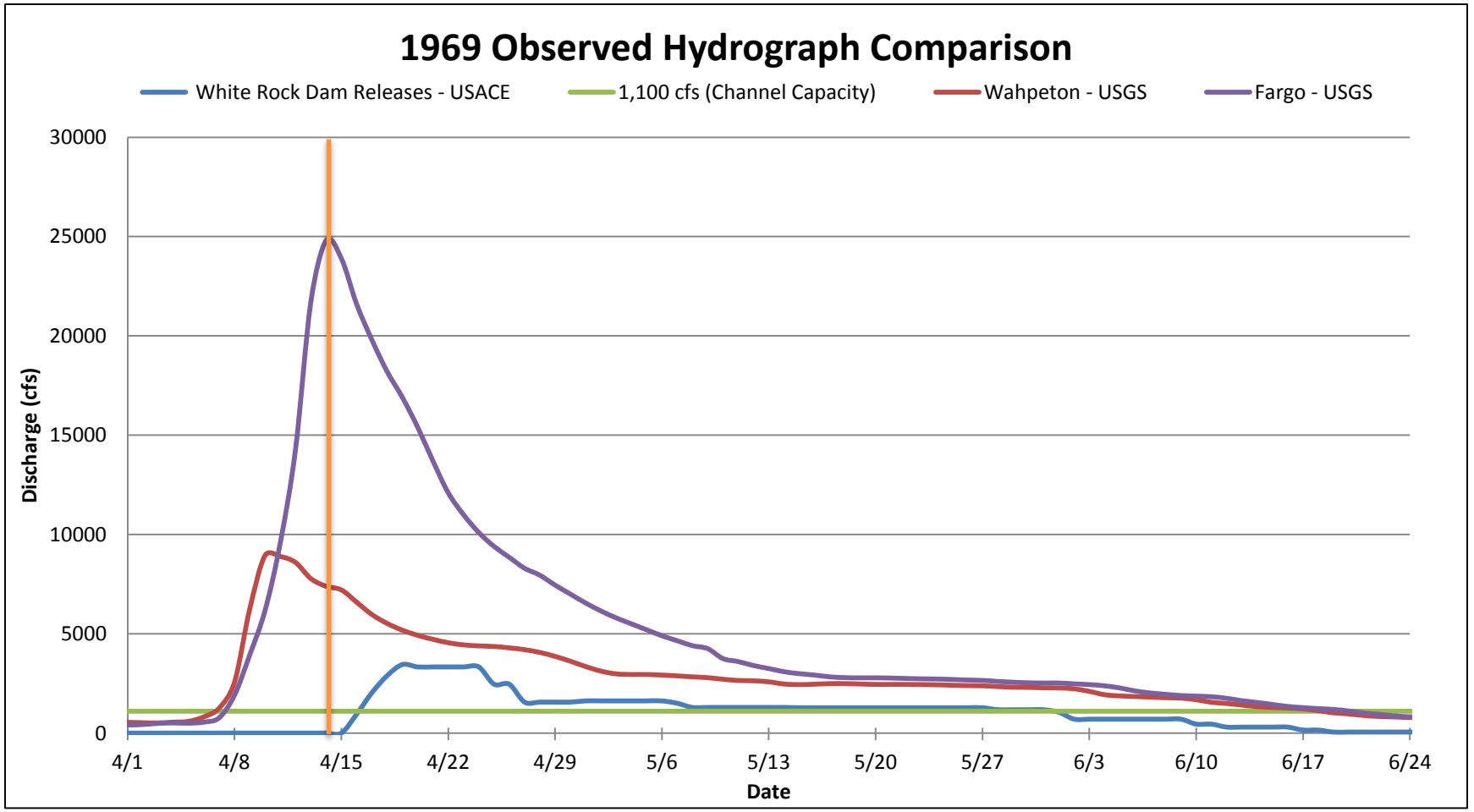


1969 Gage Data



White Rock Dam 2009

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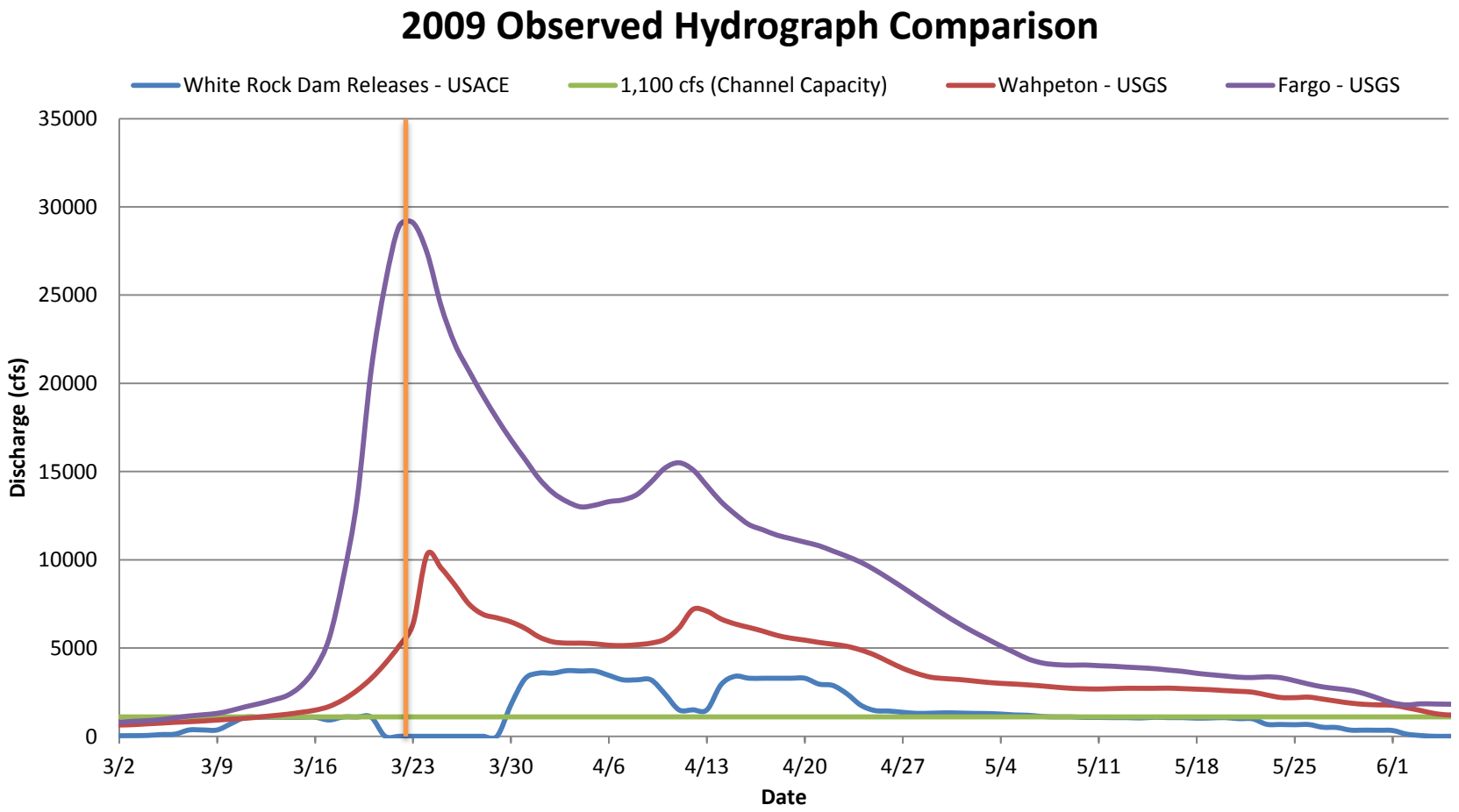

White Rock Dam 2011

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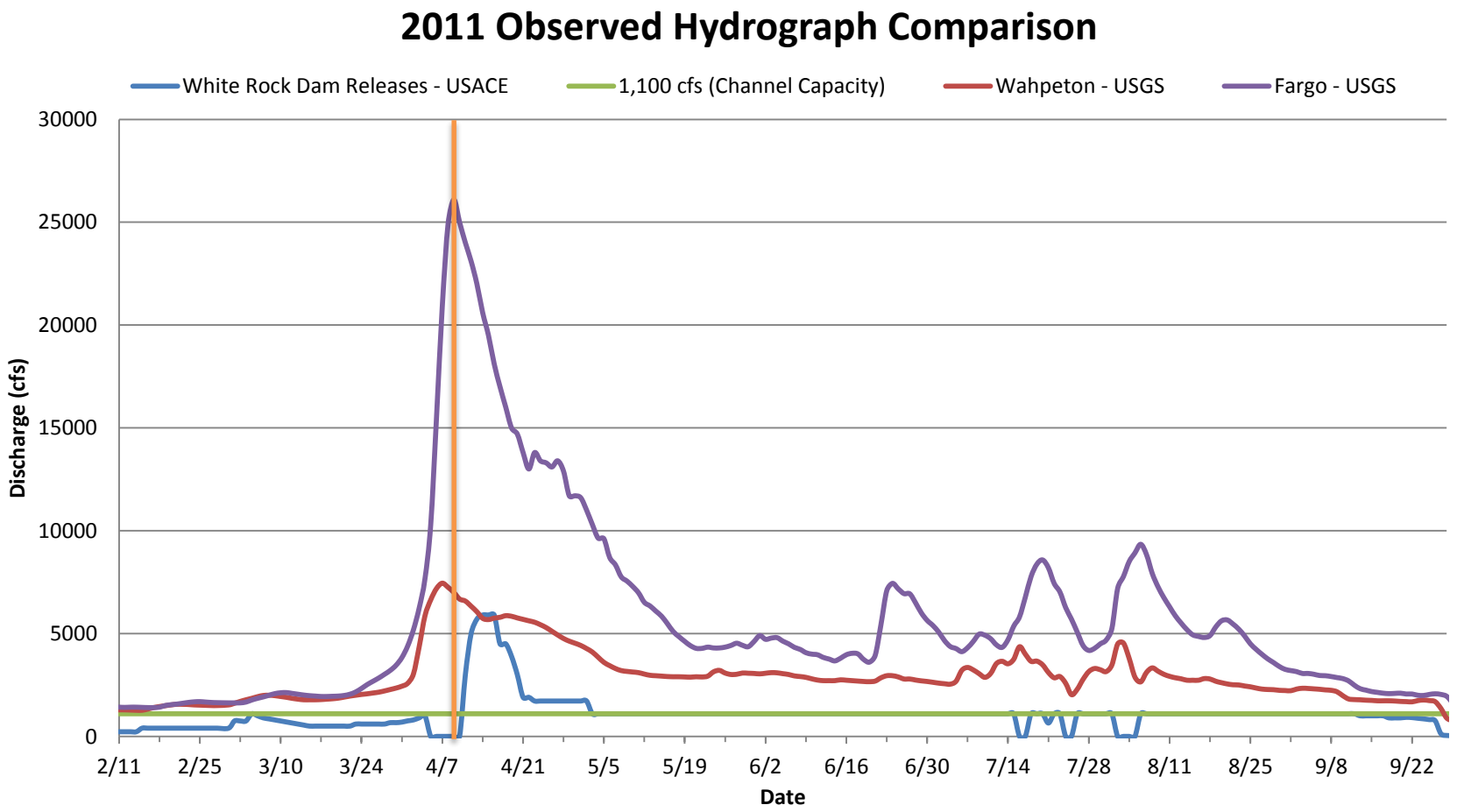
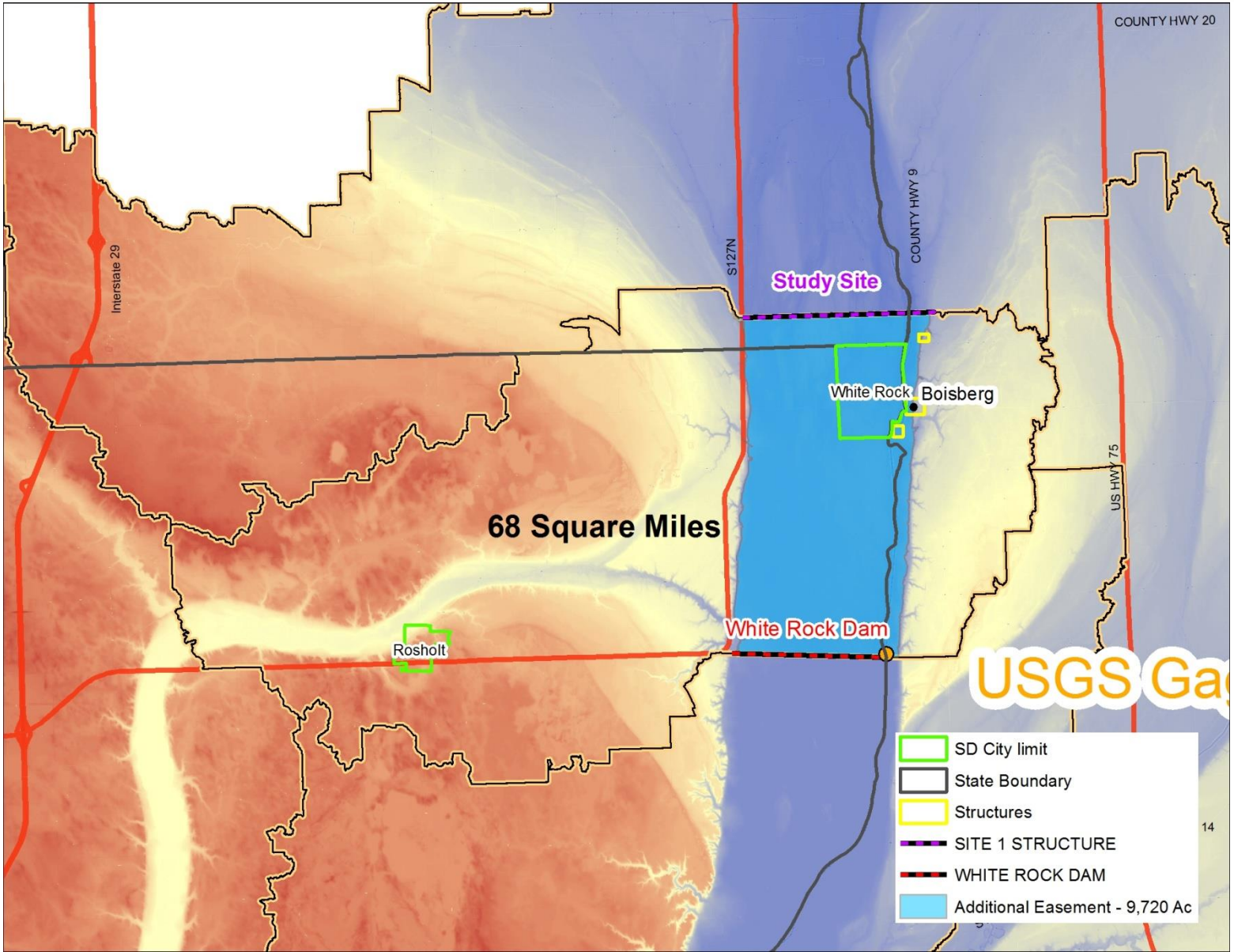


Study Site


COUNTY HWY 20
Interstate 29
S127N
COUNTY HWY 9
Study Site
White Rock
Boisberg
US HWY 75
68 Square Miles
White Rock Dam
Rosholt
USGS Ga
SD City limit
State Boundary
Structures
SITE 1 STRUCTURE
WHITE ROCK DAM
Additional Easement - 9,720 Ac
14

Study Site

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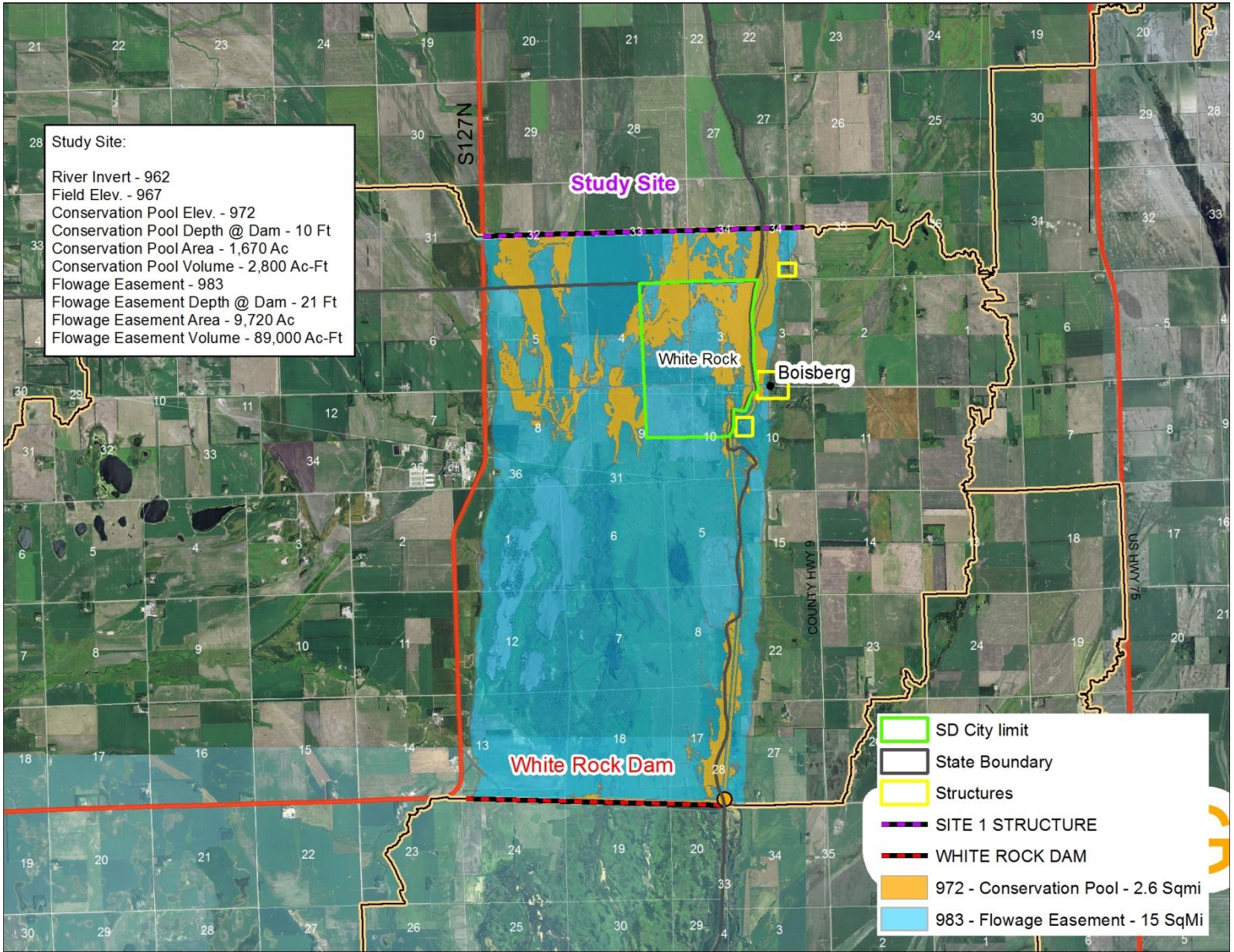

Existing Dam Vs. Improved Dam

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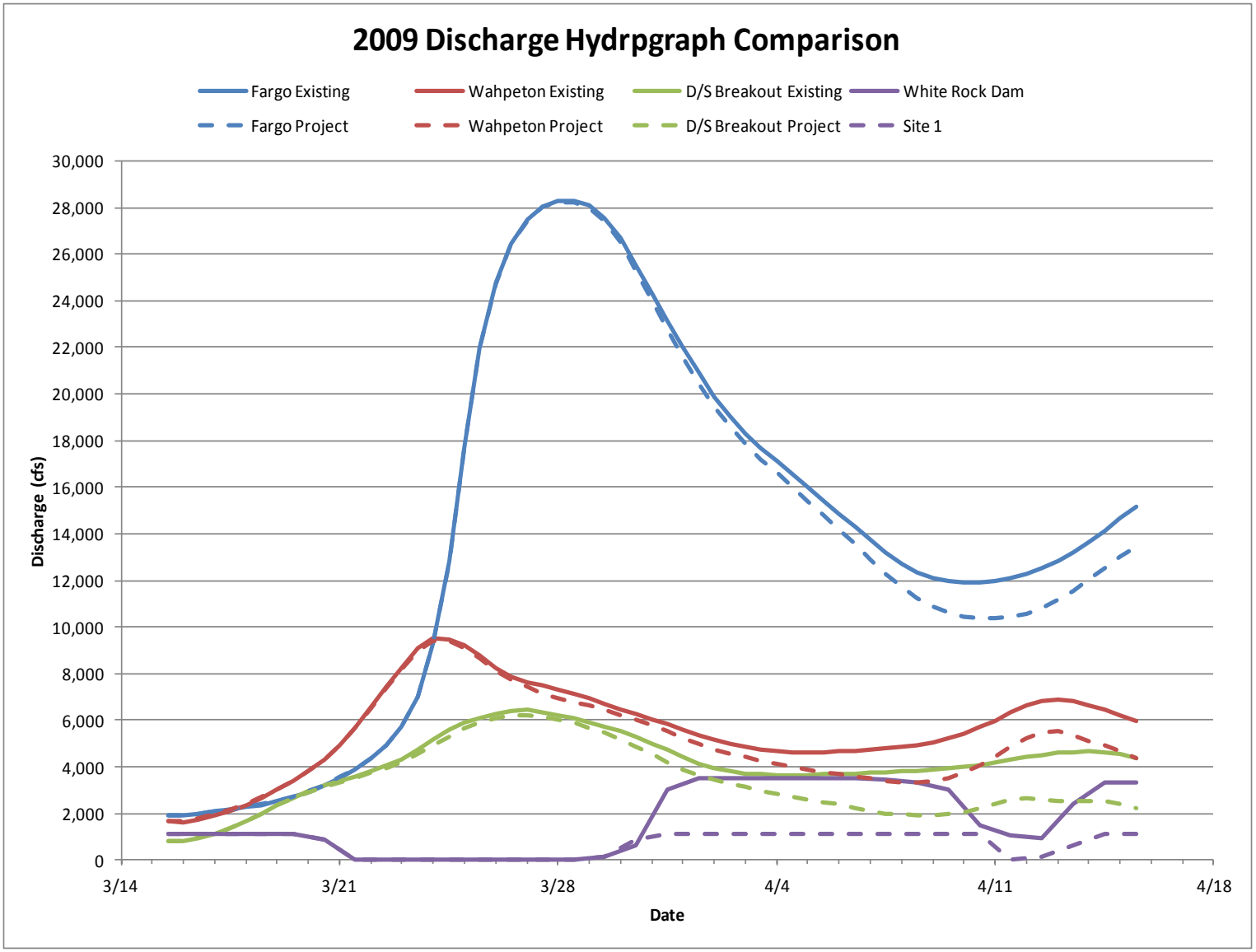
	Existing White Rock Dam Effective Storage*	Improved White Rock Dam Effective Storage*
Elevation (MSL 1912)	Storage - Acre-Ft (Inches)	Storage - Acre-Ft (Inches)
972 (Conservation Pool)	0 (0)	0 (0)
973	5,000 (0.08)	7,676 (0.12)
974	12,300 (0.20)	19,822 (0.30)
975	20,700 (0.33)	35,193 (0.54)
976	29,500 (0.48)	52,159 (0.80)
977	49,800 (0.80)	81,322 (1.24)
978	70,500 (1.14)	111,214 (1.70)
979	92,000 (1.49)	142,052 (2.17)
980	114,500 (1.85)	174,004 (2.66)
981 (Flood Zone)	137,000 (2.21)	206,357 (3.15)
982 (Max Pool Elevation)	160,500 (2.59)	238,990 (3.65)
983 (Flowage Easement)	183,500 (2.97)	272,389 (4.16)
984	207,900 (3.36)	306,046 (4.67)
985	231,800 (3.75)	339,754 (5.19)

* - Effective Storage – Does not include volume below conservation pool for both Reservation Dam or White Rock Dam.

2009 Results



100 yr Runoff

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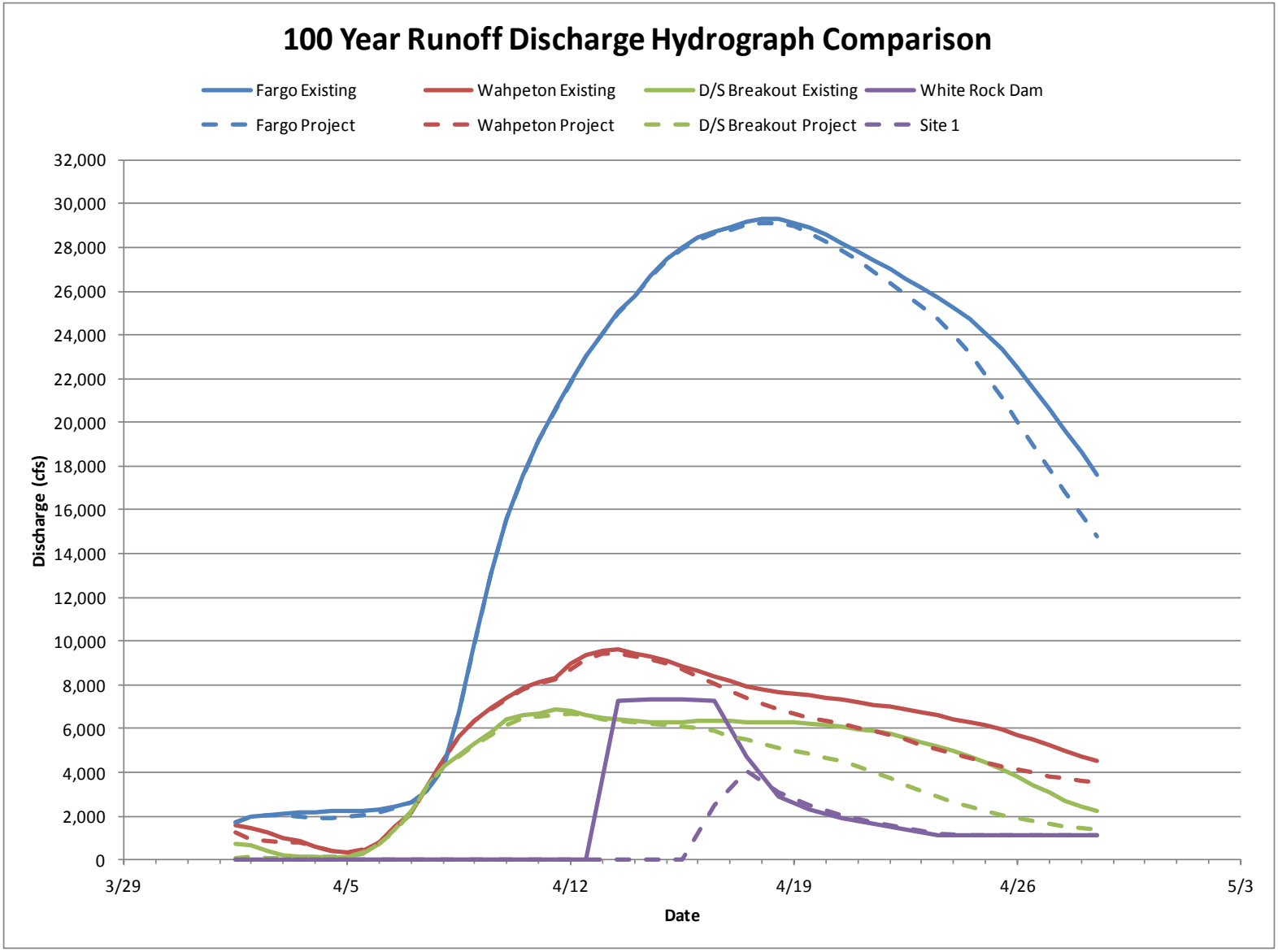

Conclusions

- For all synthetic and historic events modeled and investigated with gage data, increased storage would not have reduced the flood crest at Wahpeton or Fargo. Except for the 1997 flood.
- Increased storage volume would have reduced the flood crest at Wahpeton and potentially at Fargo for the 1997 flood.
- Increased storage volume will reduce the frequency at which flows exceed 1,100 CFS at White Rock.
- Increased storage volume will lessen the duration of downstream flooding.
- Increased storage volume will significantly reduce peak flows between White Rock and the Bois de Sioux breakouts south of Wahpeton.
- Potential benefits due to increased storage volume is greatest for exceptionally large flood events.
- Current drawdown operations (1,100 cfs) appear to exceed downstream channel capacity.

Recommendations

- Submit findings to United States Army Corps of Engineers.
- Meet with the Corps about the possibility for reducing the drawdown flow (1,100 cfs).
- Hear from Bois de Sioux Watershed on upstream sites that may accomplish the same results with added benefits to the watershed and reduced permitting difficulties.

Questions

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QUESTIONS