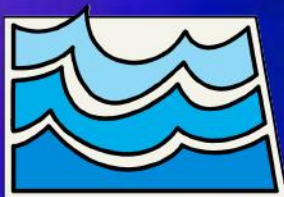


Industrial Water Depot Use and Telemetry Pilot Study



**Michael Hove
North Dakota Office of the State Engineer**

Main Topics

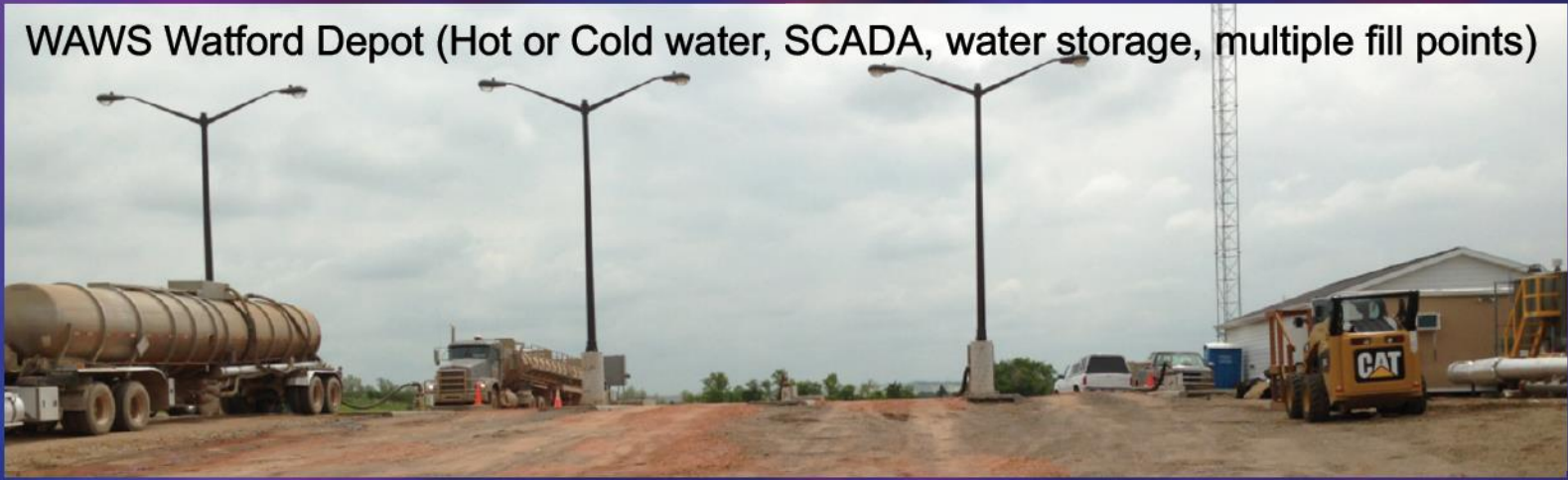
- **Water Depot Use :**
- **Water Resource Monitoring**
- **Real-Time Water Use Monitoring (Telemetry):**

What is a Water Depot?

**Variety of Water Depot Construction
Examples**

Depot Construction Examples

WAWS Watford Depot (Hot or Cold water, SCADA, water storage, multiple fill points)



Timber Creek Depot (Hot or Cold water, SCADA, water storage, multiple fill points)

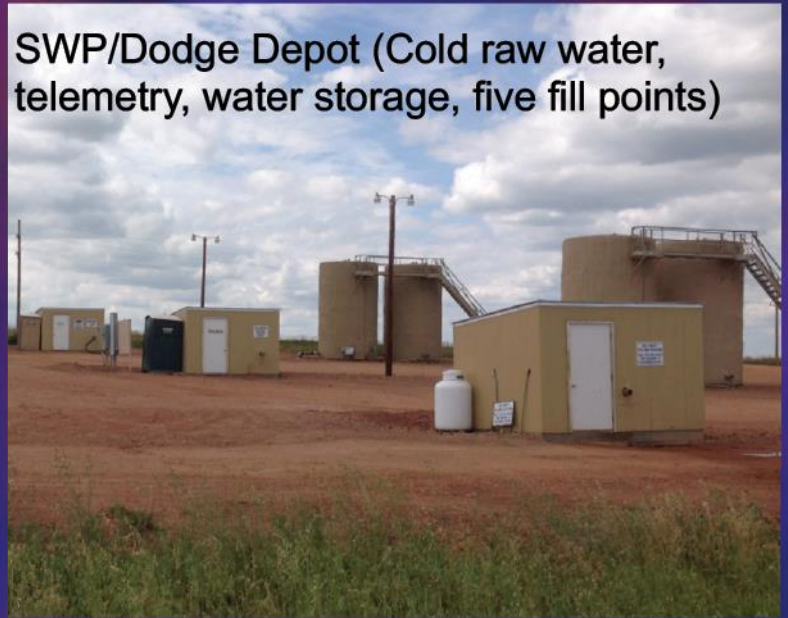


Depot Construction Examples

Williston Depot (Cold potable water, SCADA, water storage, two fill points)



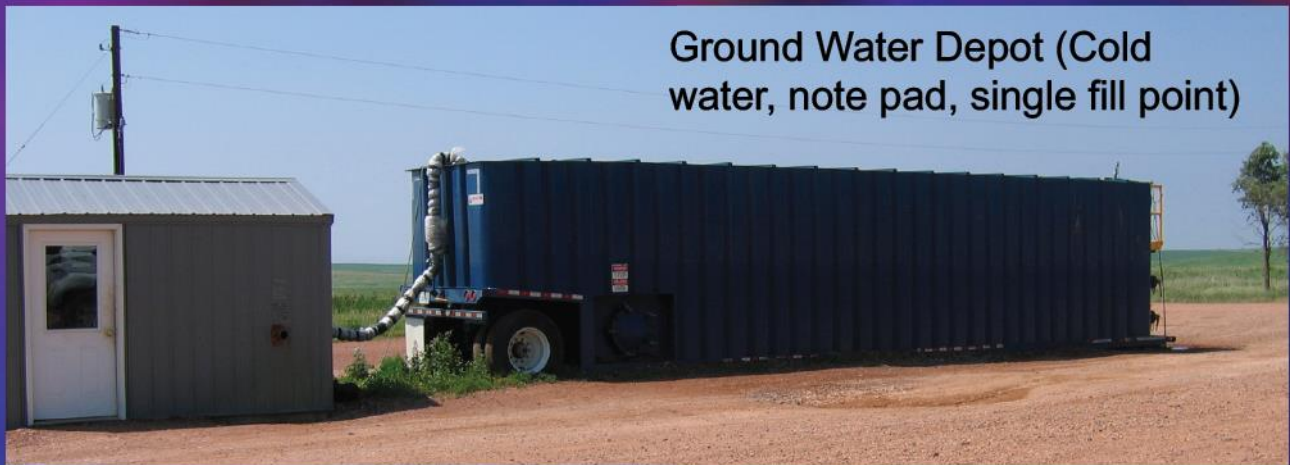
SWP/Dodge Depot (Cold raw water, telemetry, water storage, five fill points)



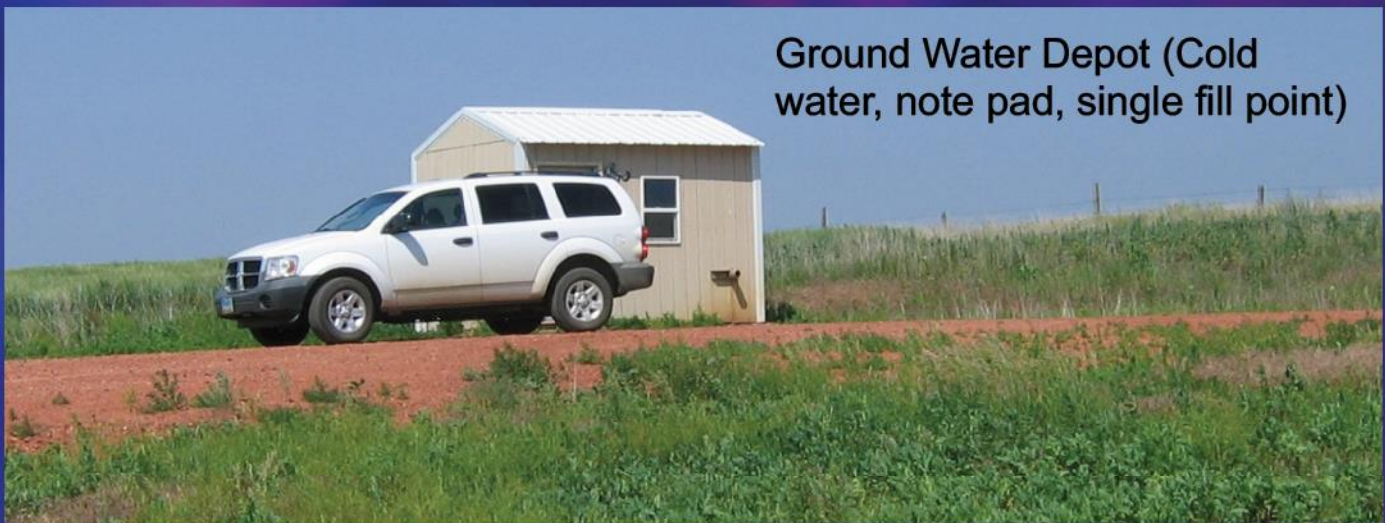
Athens Depot (Cold raw water, SCADA, four fill points)



Depot Construction Examples



Ground Water Depot (Cold water, note pad, single fill point)



Ground Water Depot (Cold water, note pad, single fill point)

Depot Construction Examples

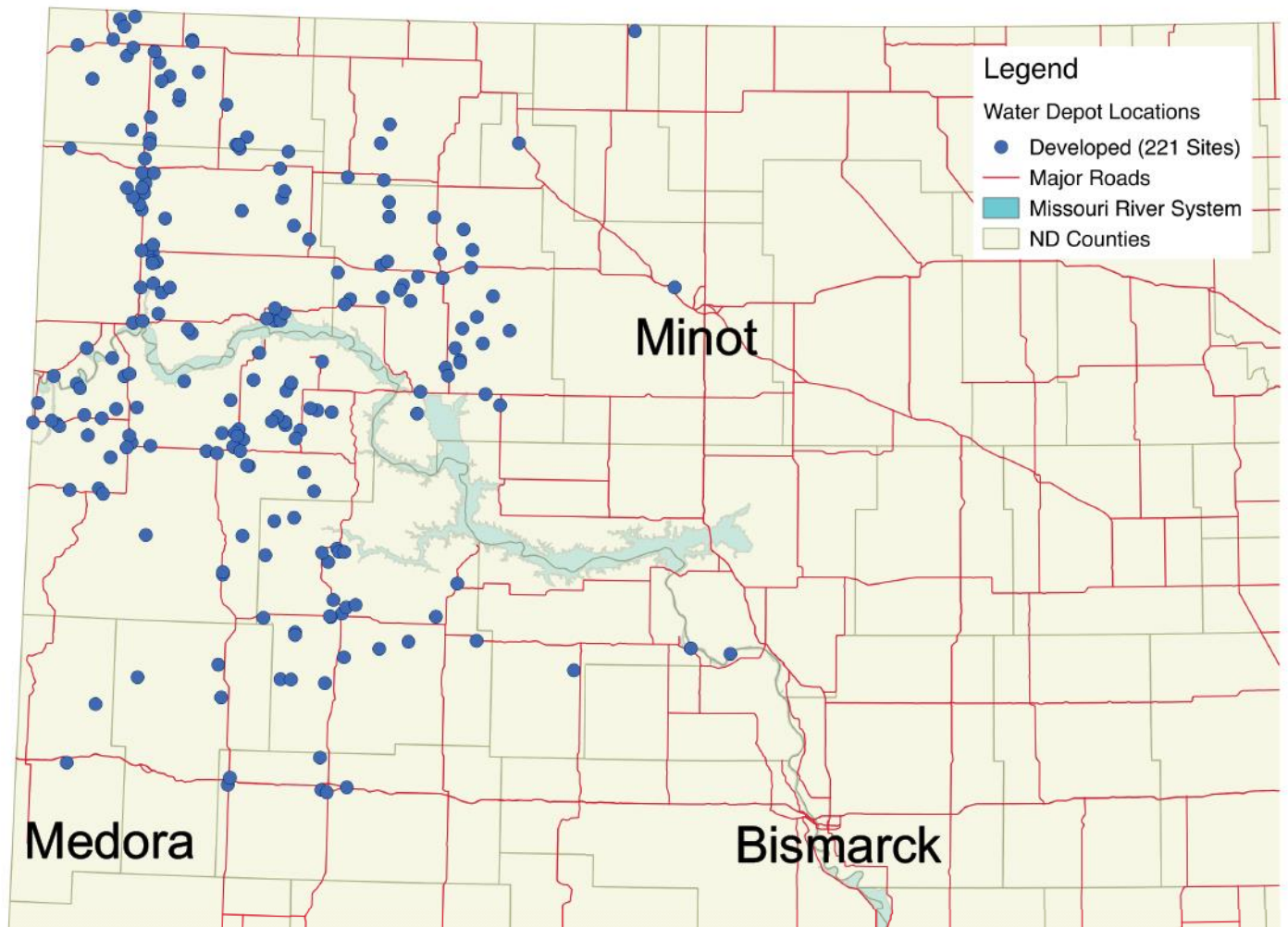
Surface Water Depot (Cold raw water, note pad, single fill point)



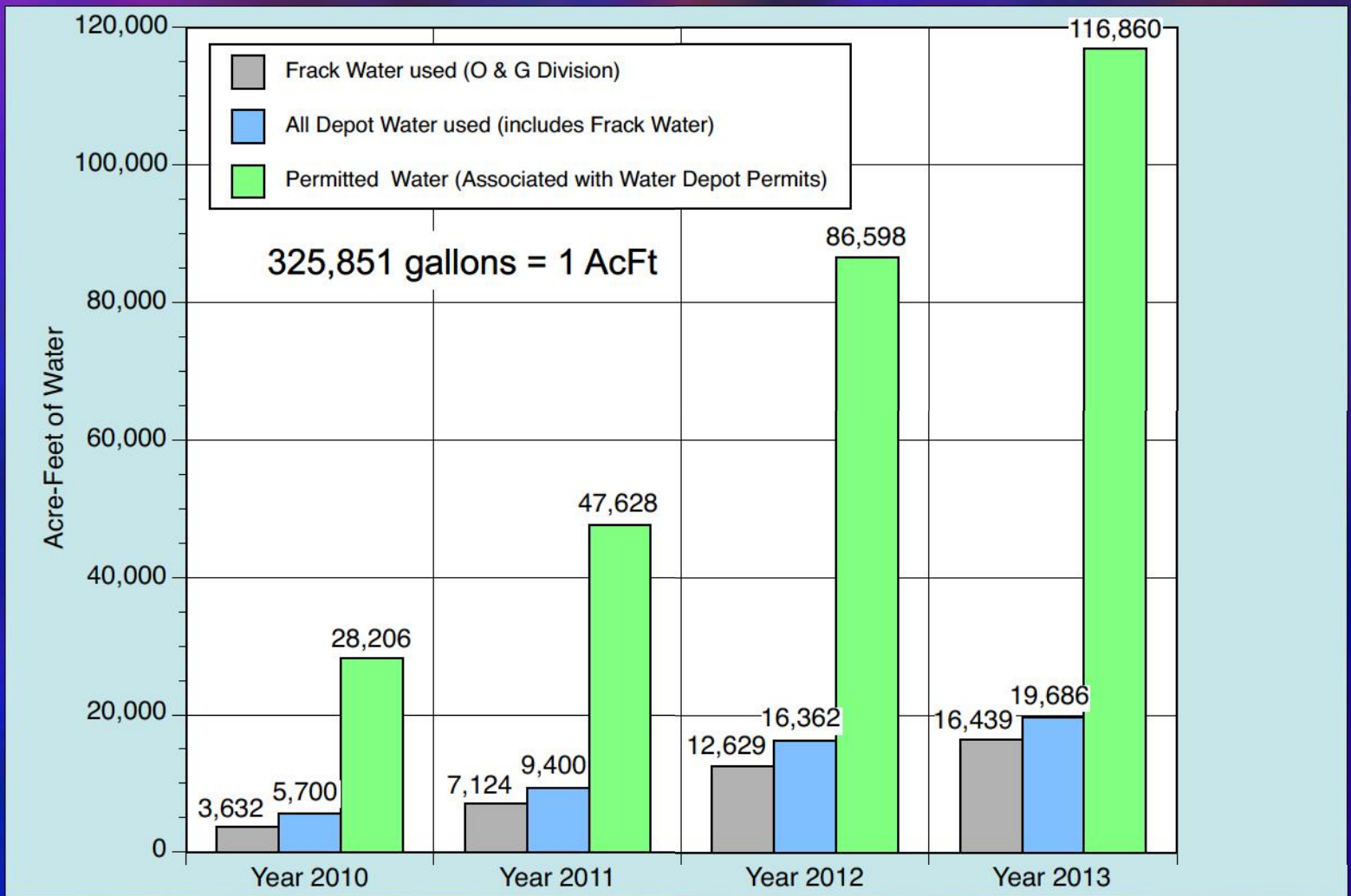
Surface Water Depot (Cold raw water, note pad, single fill point)



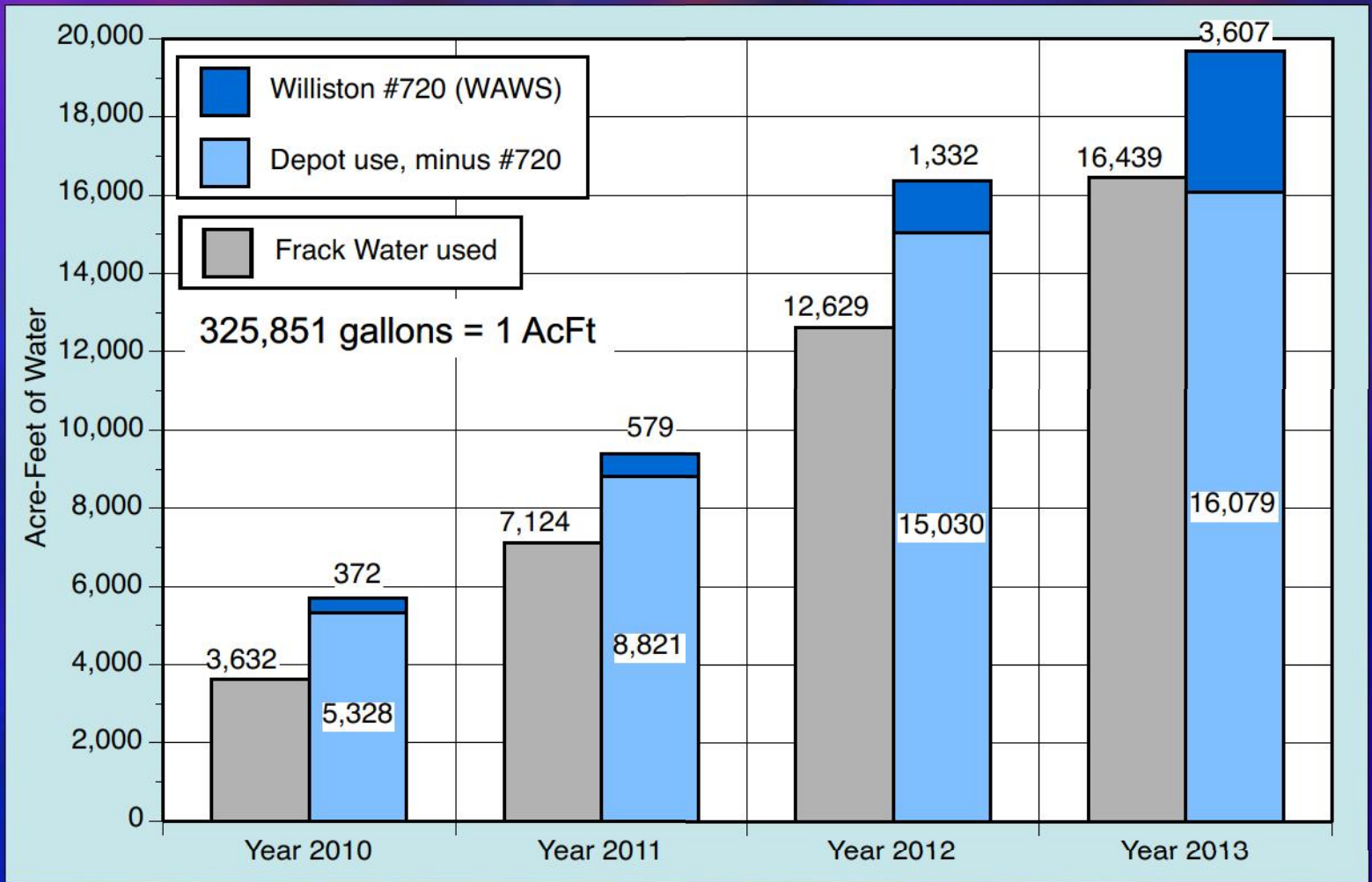
Active Water Depots : 221 Sites



Water Pemits & Use in the Bakken



Water Depot Use in the Bakken



Water Depot Use in the Bakken : 2012 & 2013

July 2014 Office of the N.D. State Engineer	2012 Water Use (Ac-Ft)	2013 Water Use (Ac-Ft)
Conditional / Perfected Permits	5,911	6,866
Temporary Permits	4,438	5,603
Industrial In-Lieu-Of Irrigation Permits	4,100	2,937
Municipal Permits	1,674	3,626
Non-Permitted Use **	39	54
Tribal Use ***	200	600
Totals	16,362	19,686

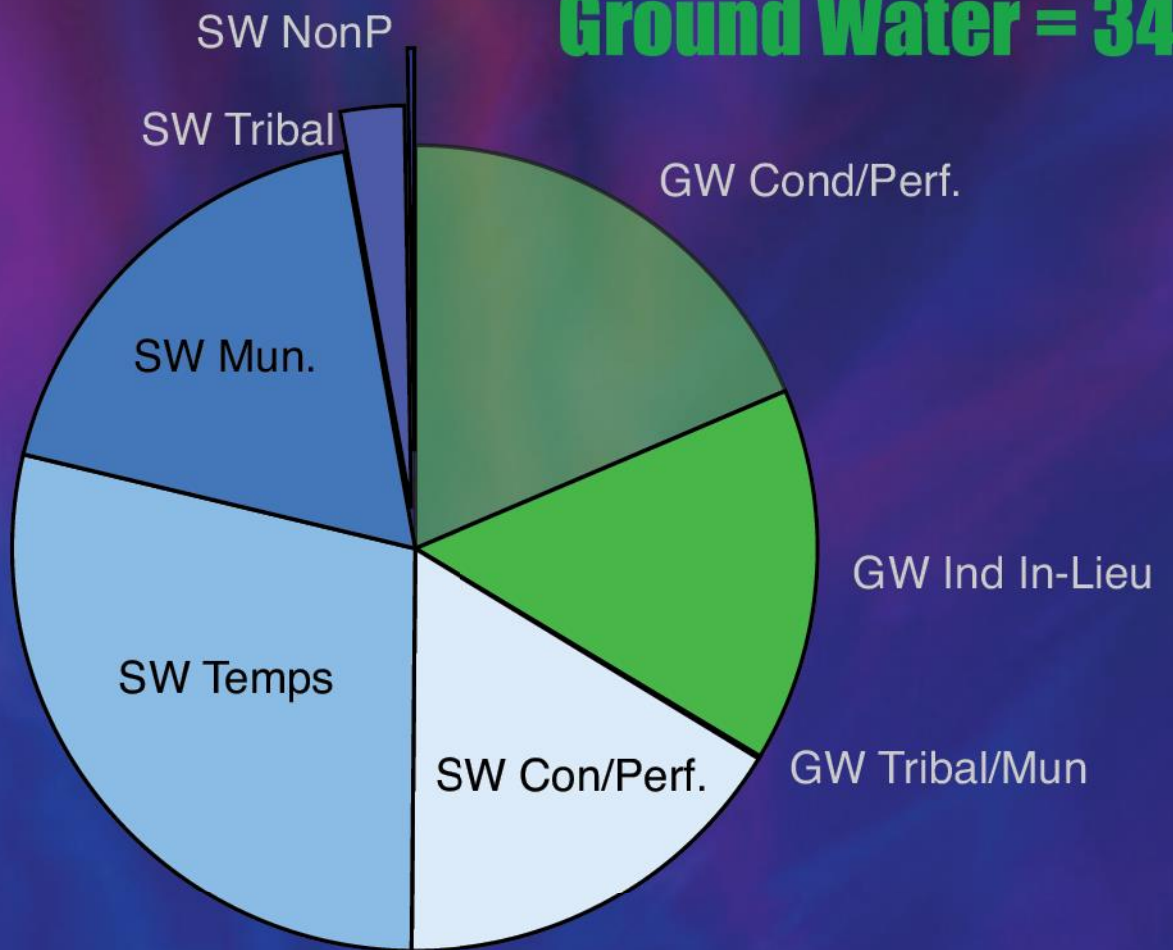
Water Depot Use in the Bakken : 2013 GW & SW

July 2014 Office of the N.D. State Engineer	G.W. 2013 Water Use (Ac-Ft)	S.W. 2013 Water Use (Ac-Ft)	Total 2013 Water Use (Ac-Ft)
Conditional / Perfected Permits	3,644	3,222	6,866
Temporary Permits	0	5,603	5,603
Industrial In-Lieu-Of Irrigation Permits	2,937	0	2,937
Municipal Permits	19	3,607	3,626
Non-Permitted Use **	0	54	54
Tribal Use ***	100	500	600
Totals	6,700	12,986	19,686

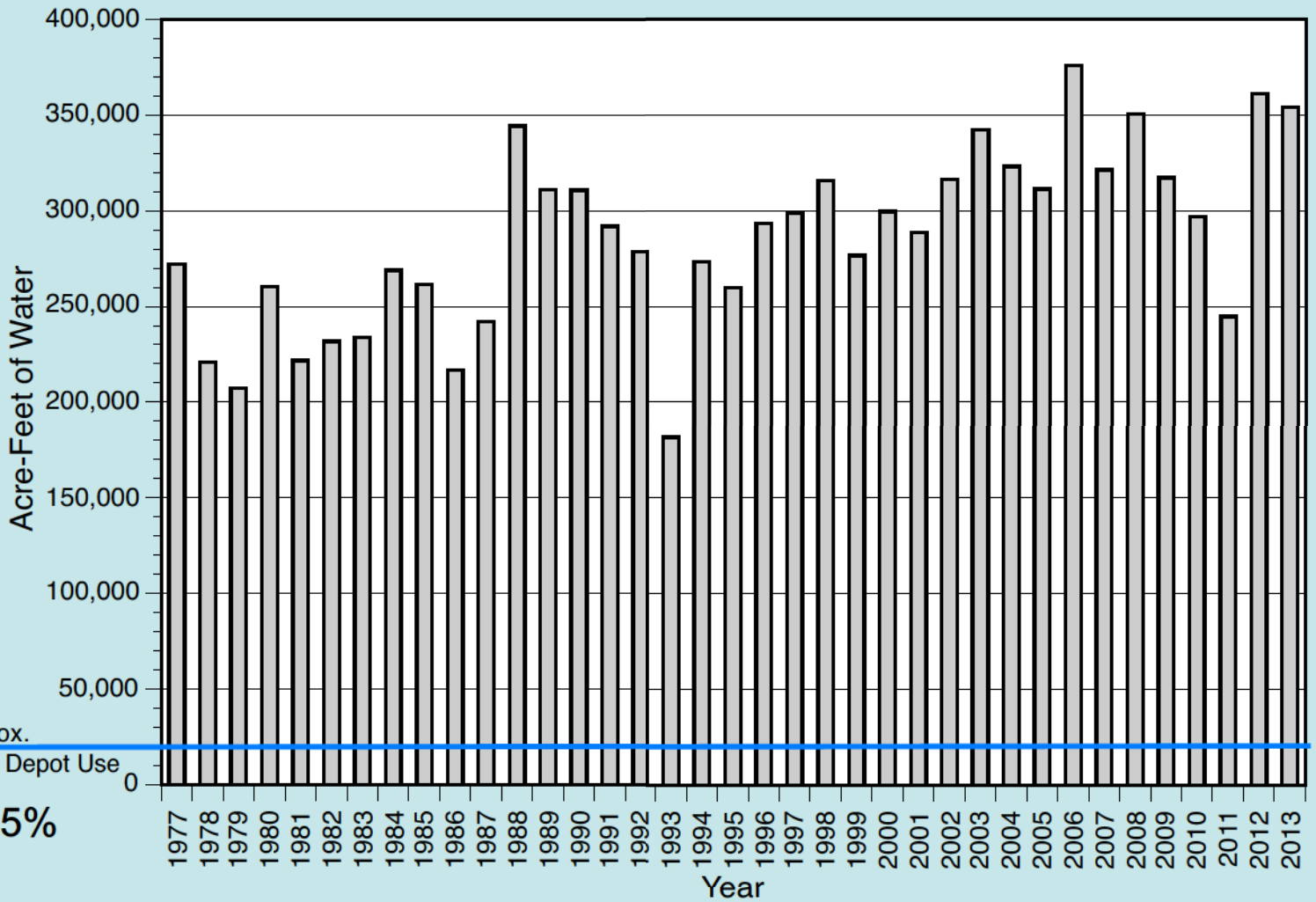
Water Depot Use in the Bakken : 2013 GW & SW

Surface Water = 66%

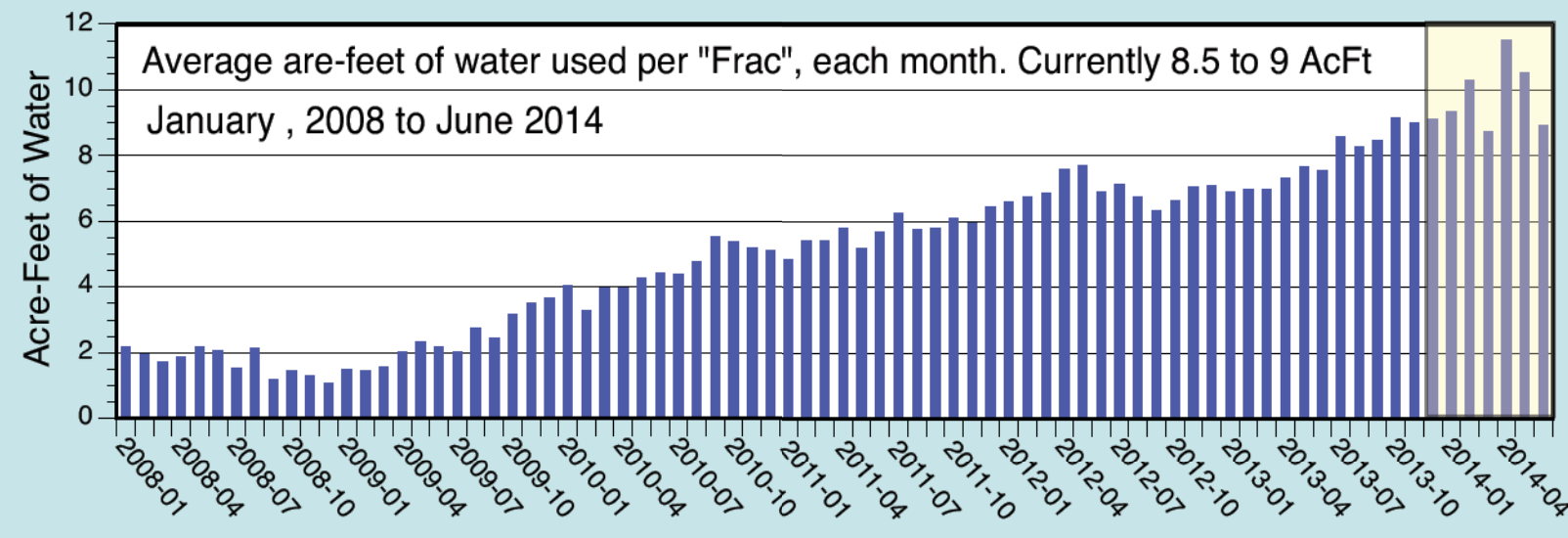
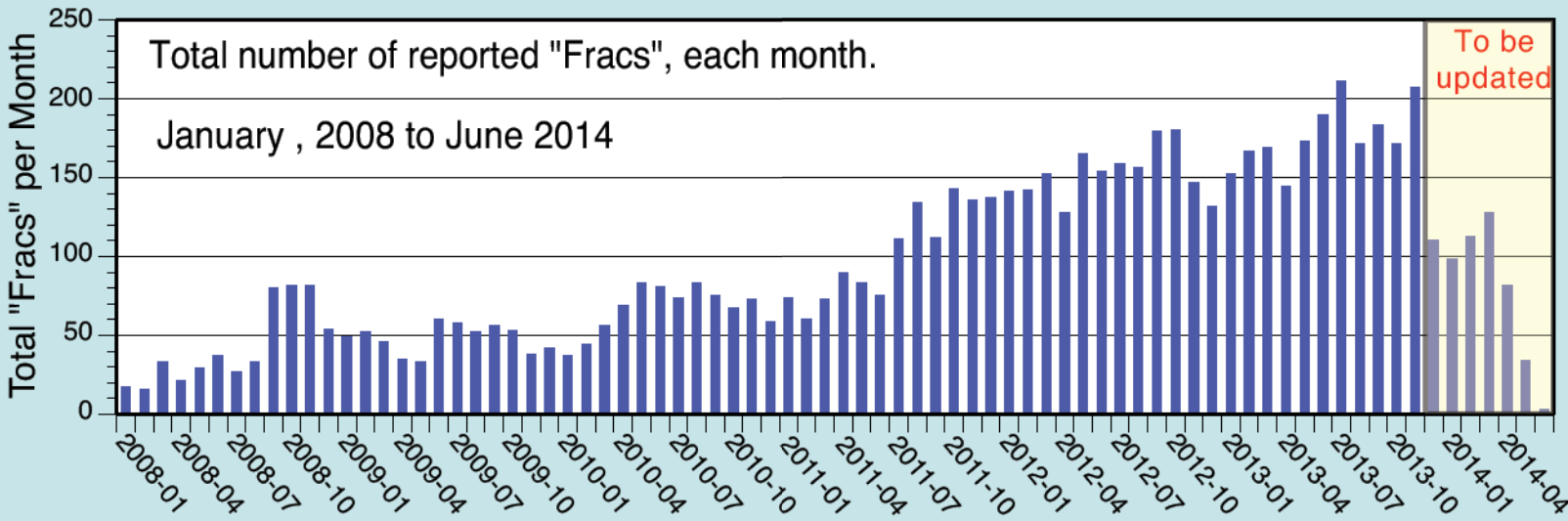
Ground Water = 34%



Annual Report Water Use – All Permits

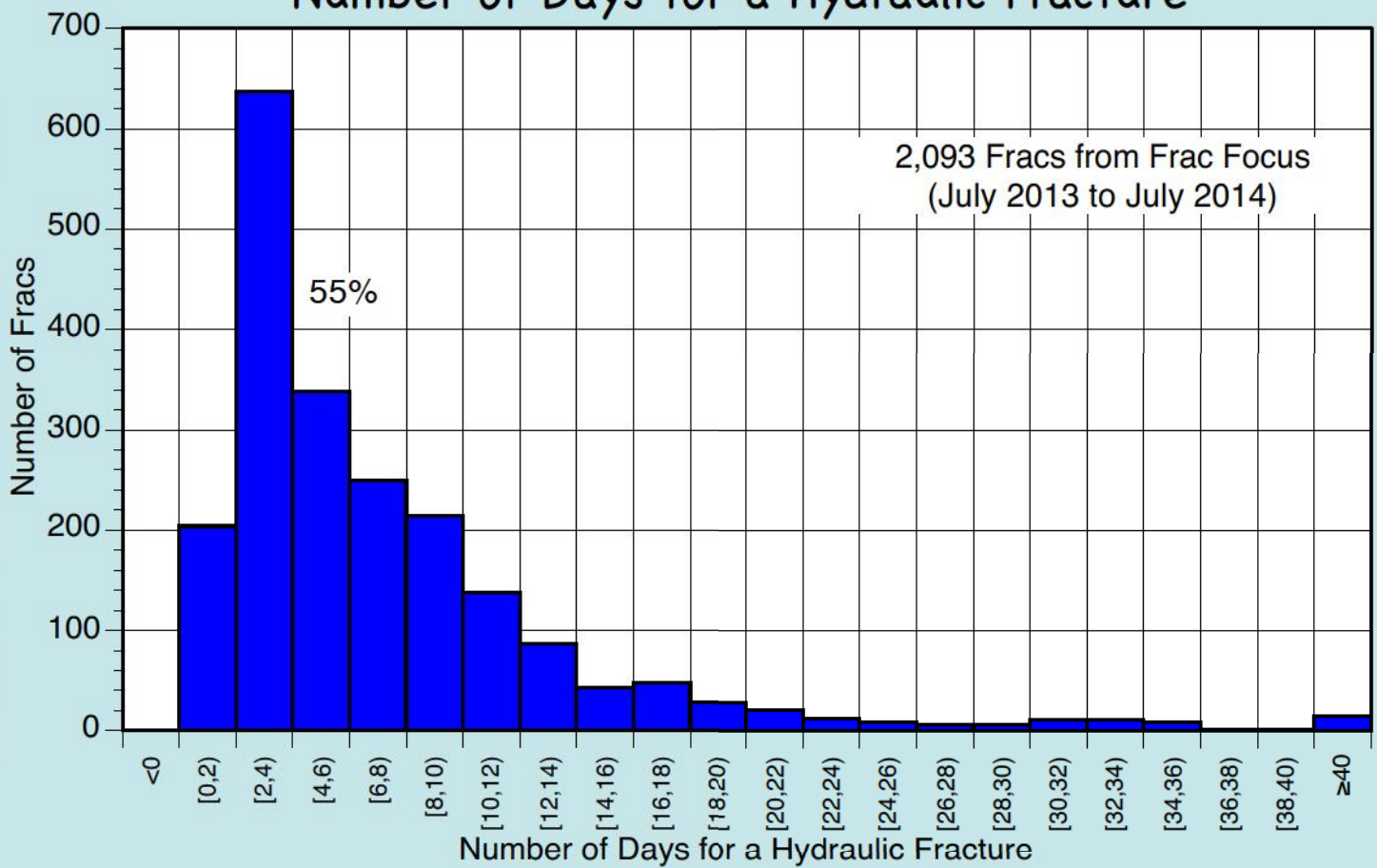


Water Fracturing in the Bakken

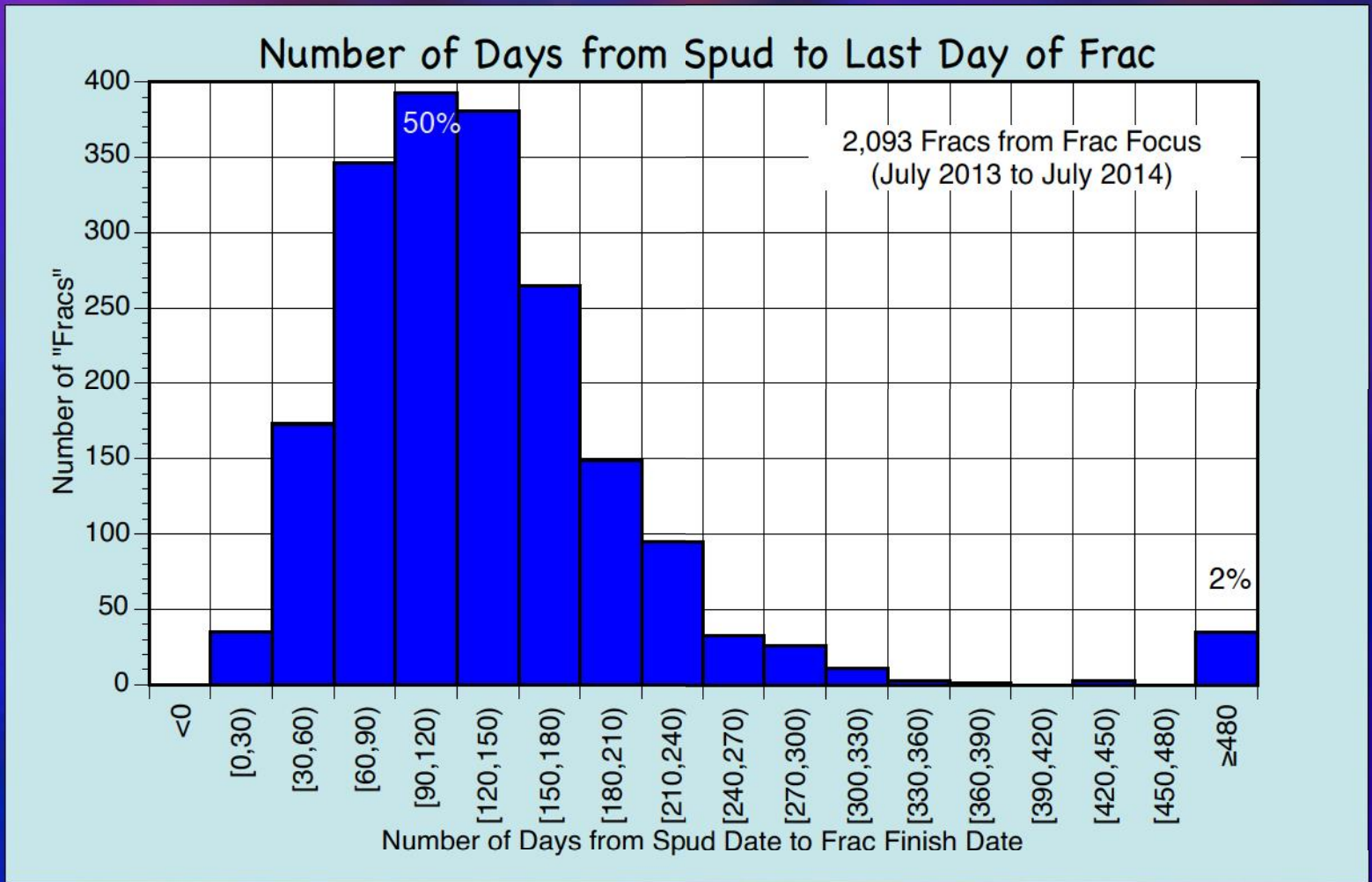


Water Fracturing in the Bakken

Number of Days for a Hydraulic Fracture



Water Fracturing in the Bakken



Water Resource Monitoring

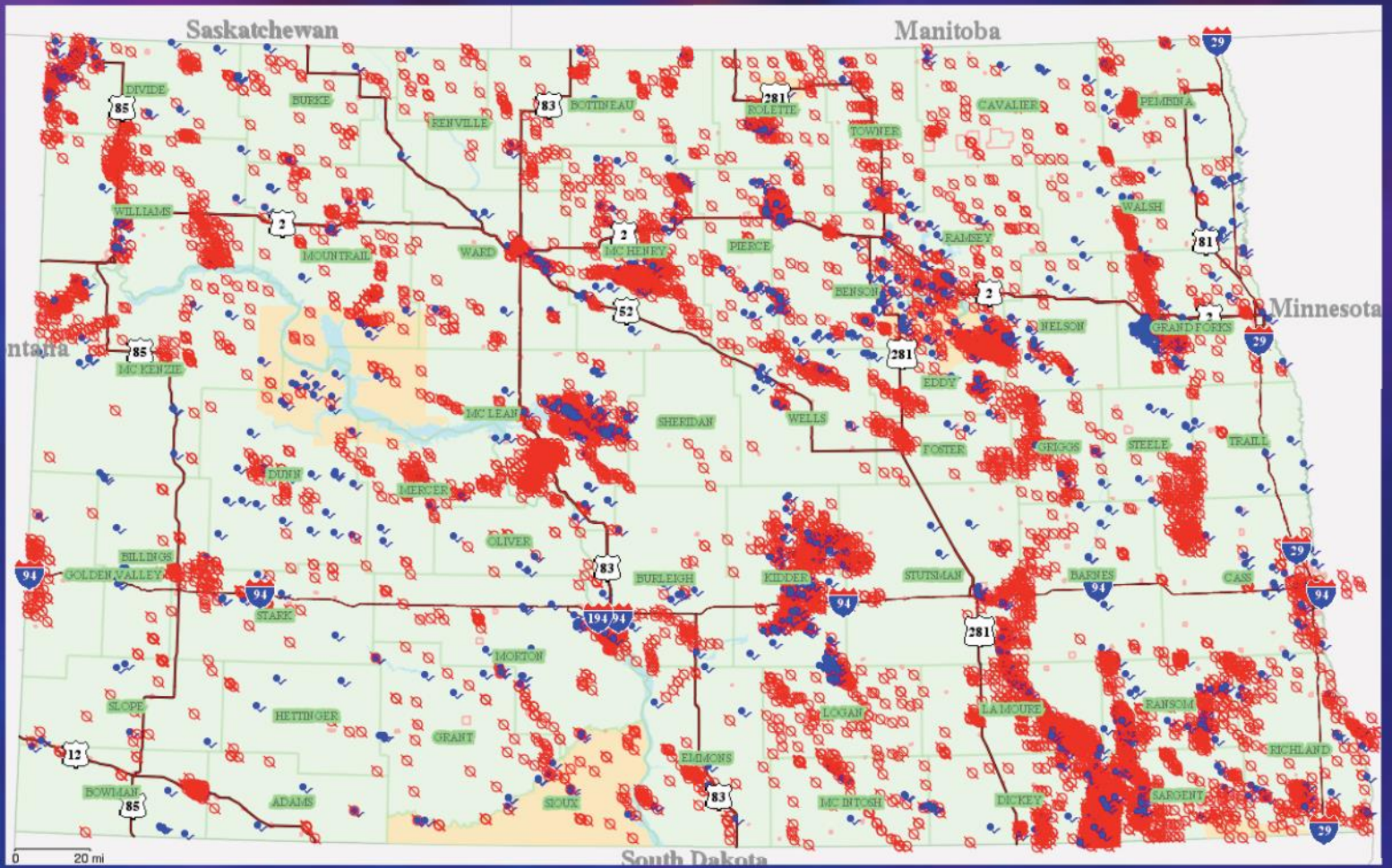
Ground Water:

- 1. Obs. well network : ~ 4,200 wells monitored month/qrt**
- 2. Drill Rig : approx 125 test holes/obs wells per Yr.**
- 3. Water Samples : 800 - 1,000 wells per year.**

Surface Water:

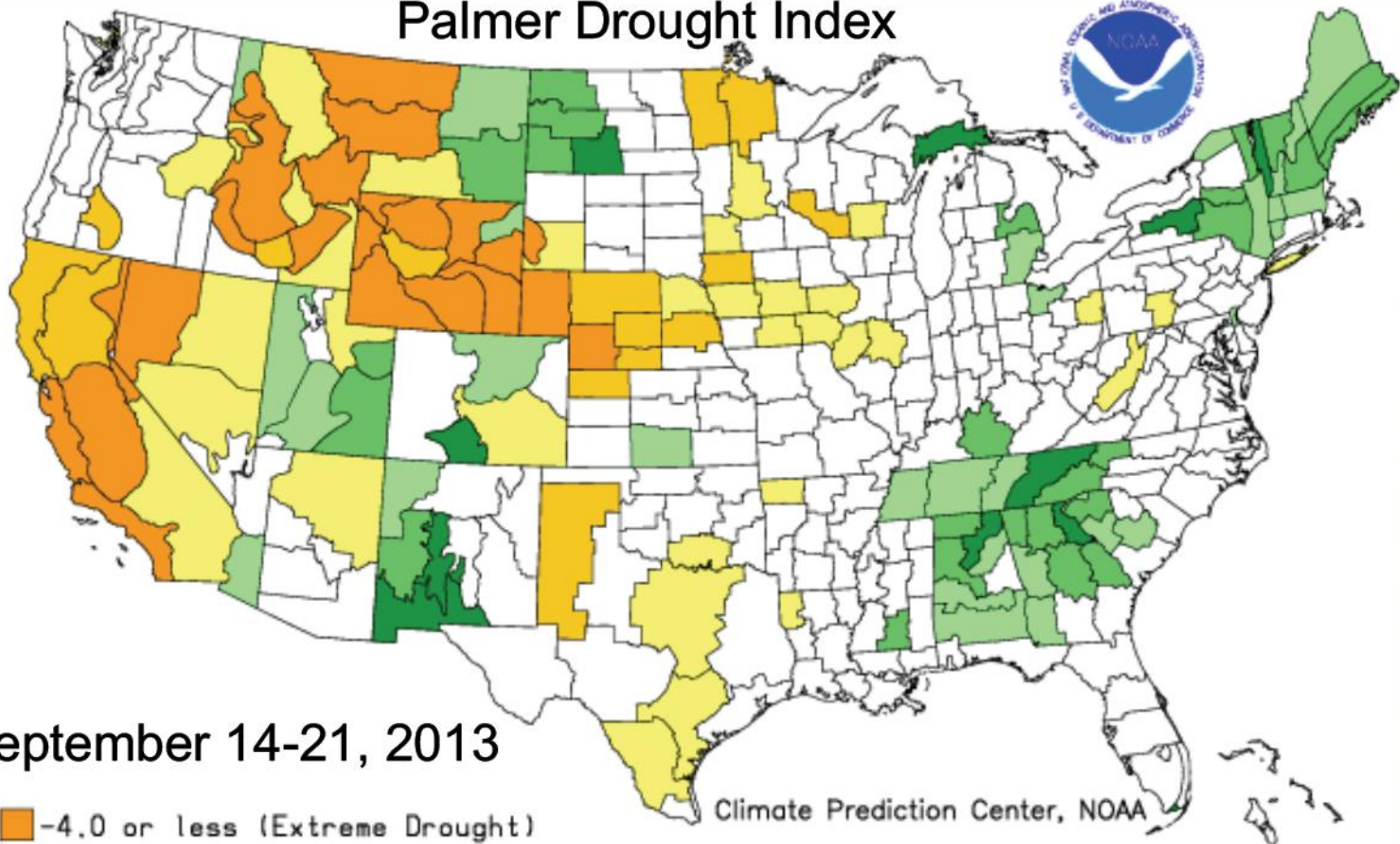
- 1. Gage network : ~ 257 sites monitored day/month/qrt**
- 3. Water Samples : 75- 150 sites per year.**
- 4. NWS & ARB Precipitation Data**
- 5. Landsat TM satellite data – Water area analysis**

Water Resource Monitoring



NWS Precipitation Monitoring

Palmer Drought Index



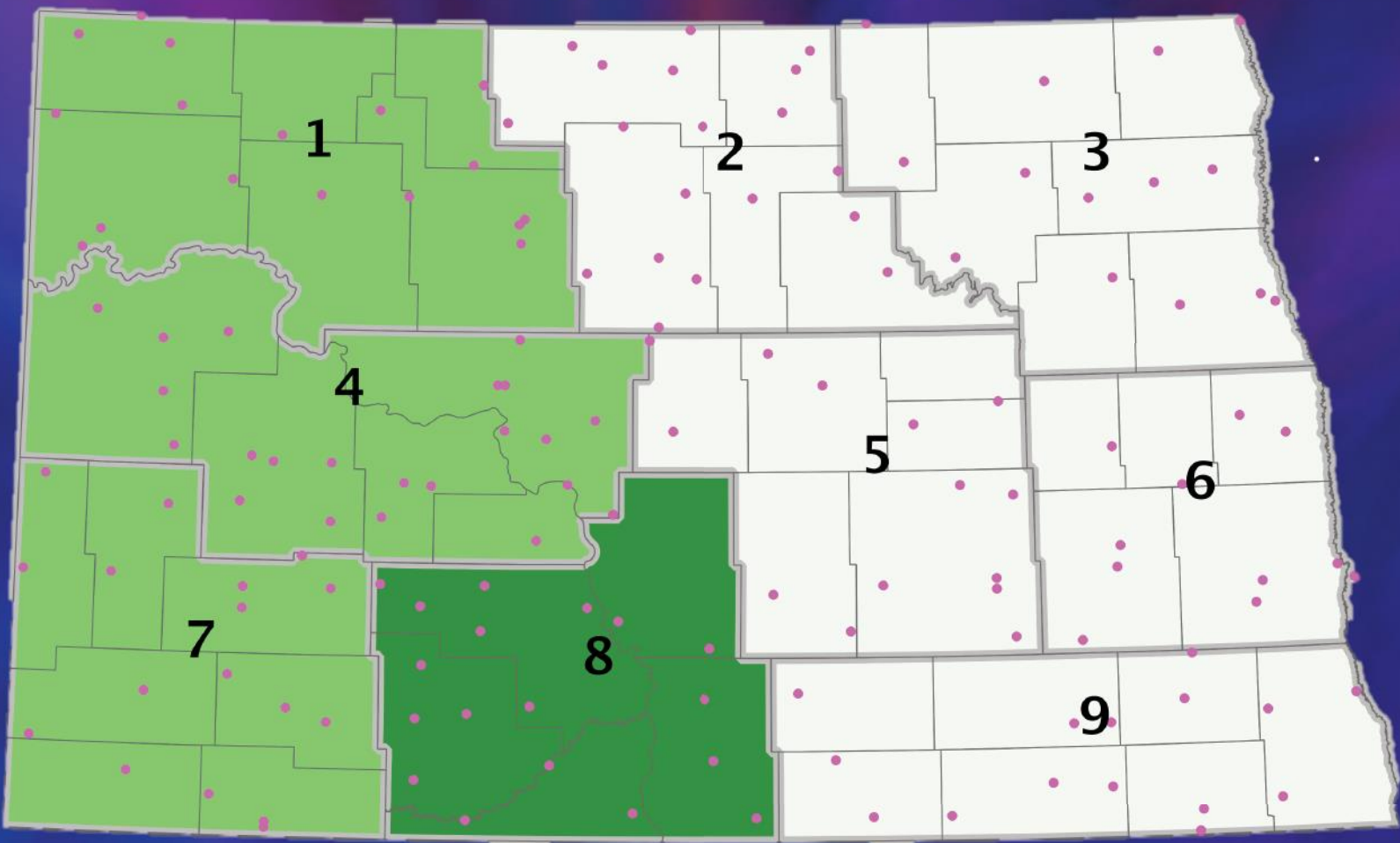
September 14-21, 2013

- 4.0 or less (Extreme Drought)
- 3.0 to -3.9 (Severe Drought)
- 2.0 to -2.9 (Moderate Drought)
- 1.9 to +1.9 (Near Normal)

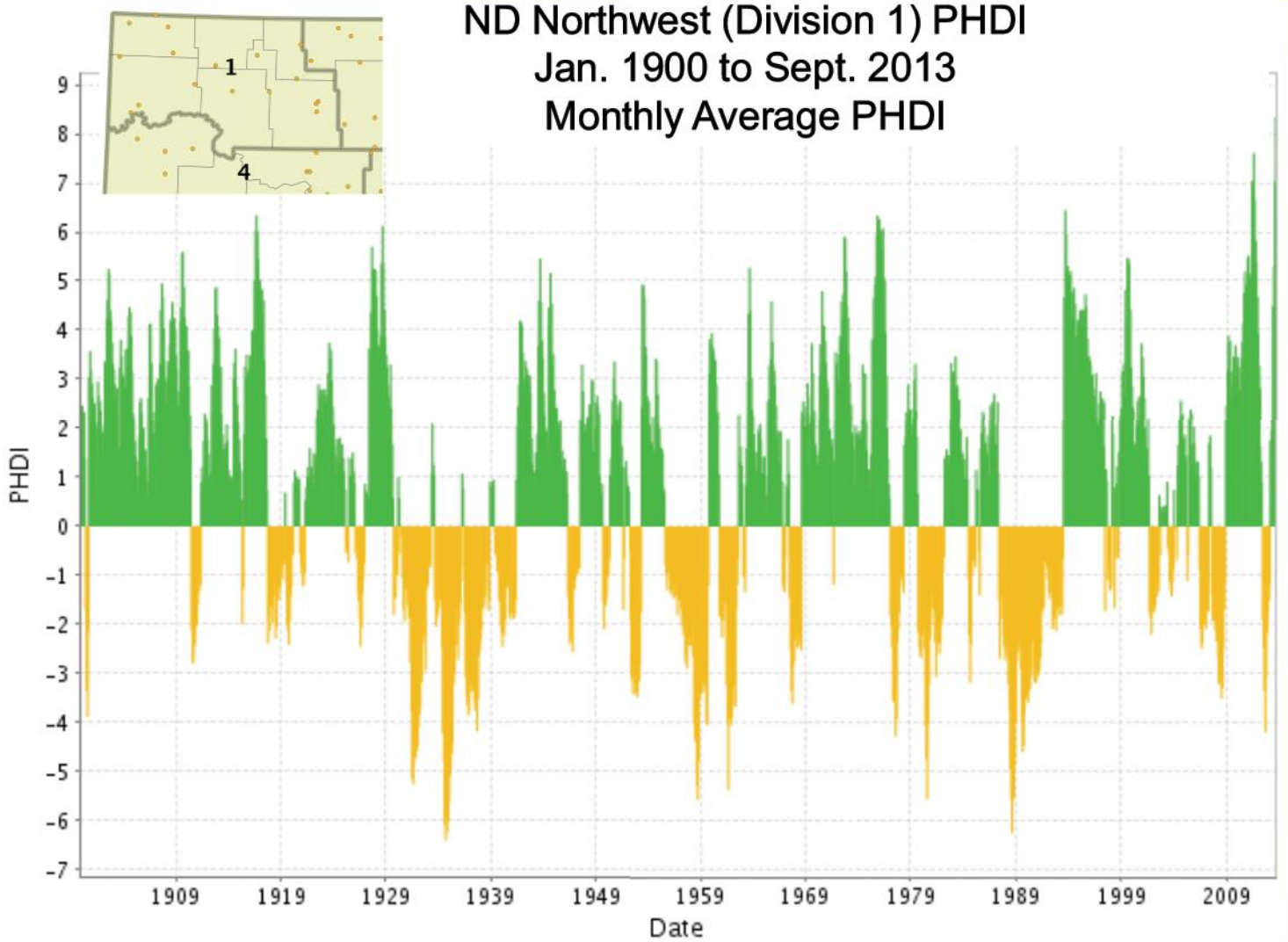
- +2.0 to +2.9 (Unusual Moist Spell)
- +3.0 to +3.9 (Very Moist Spell)
- +4.0 and above (Extremely Moist)

NWS Precipitation Monitoring : 145 Obs.

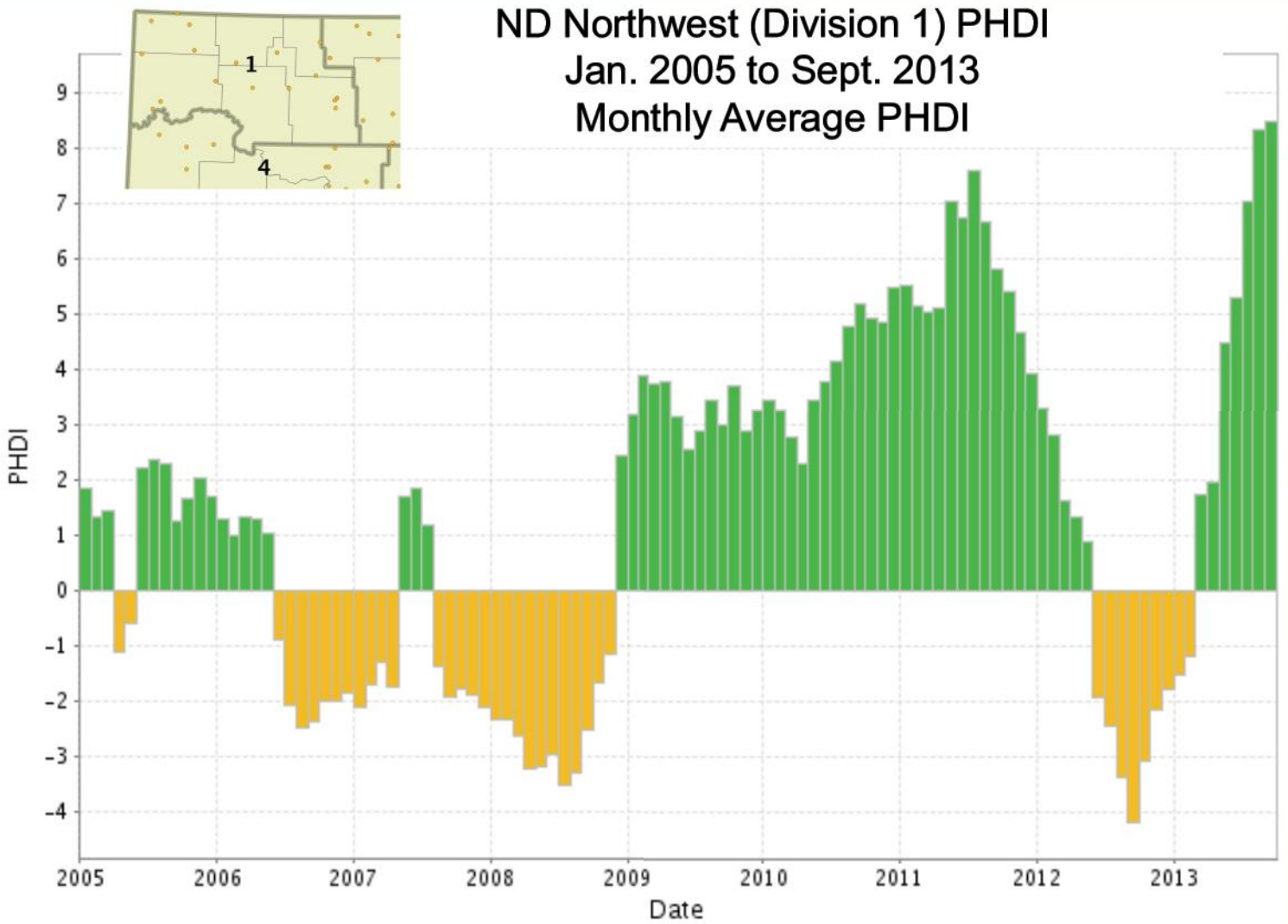
September 14-21, 2013



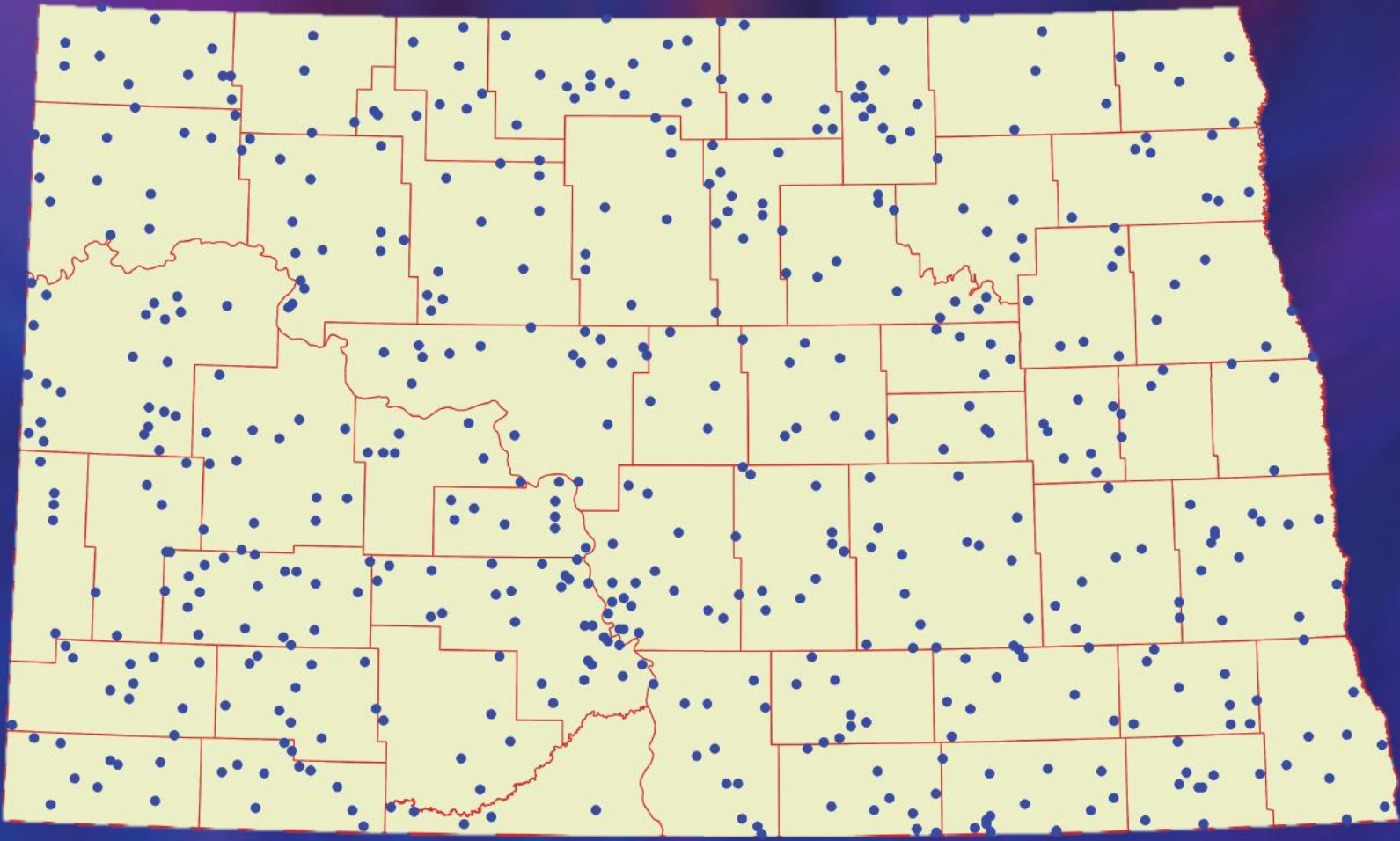
NWS Precipitation Monitoring



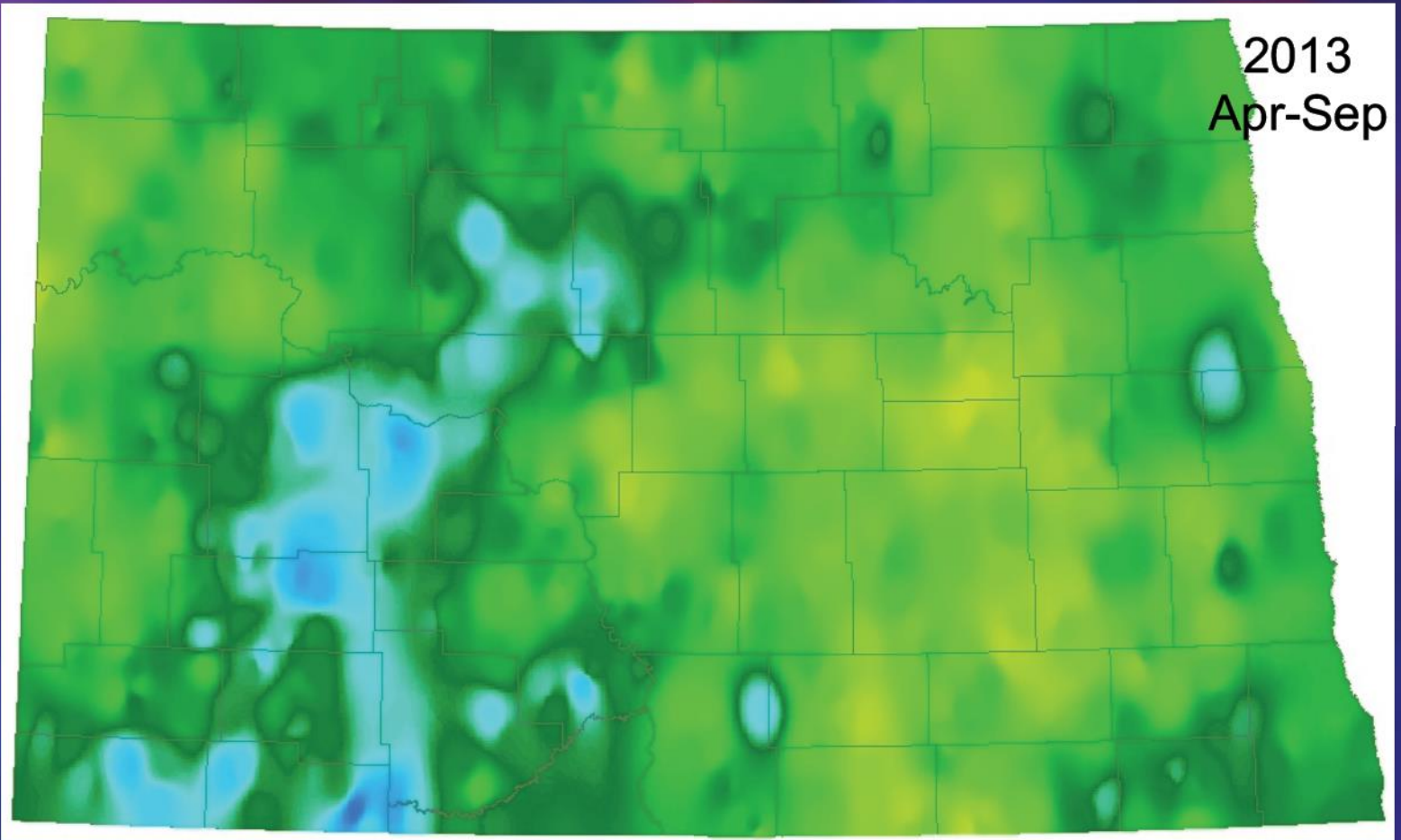
NWS Precipitation Monitoring



ARB Precipitation Monitoring : ~700 obs.

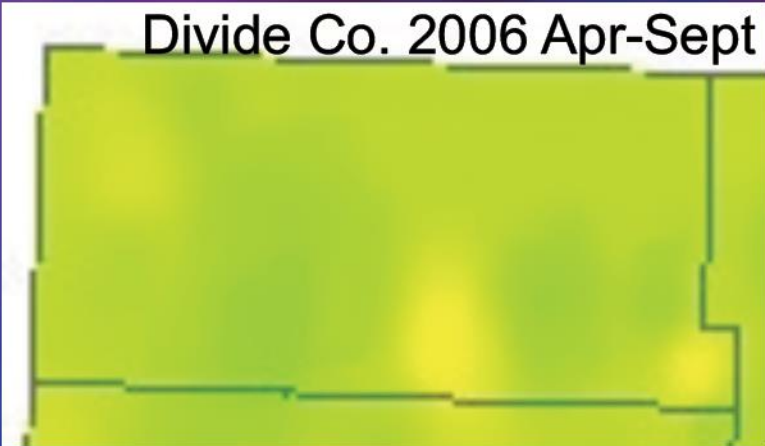


ARB Precipitation Monitoring Maps

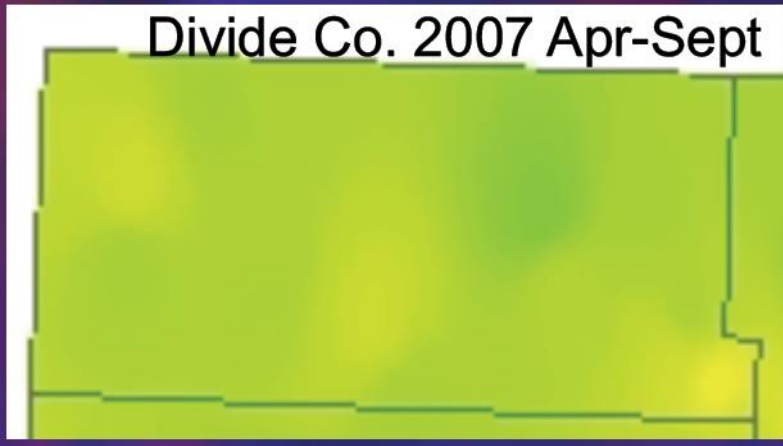


ARB Precipitation Monitoring Maps

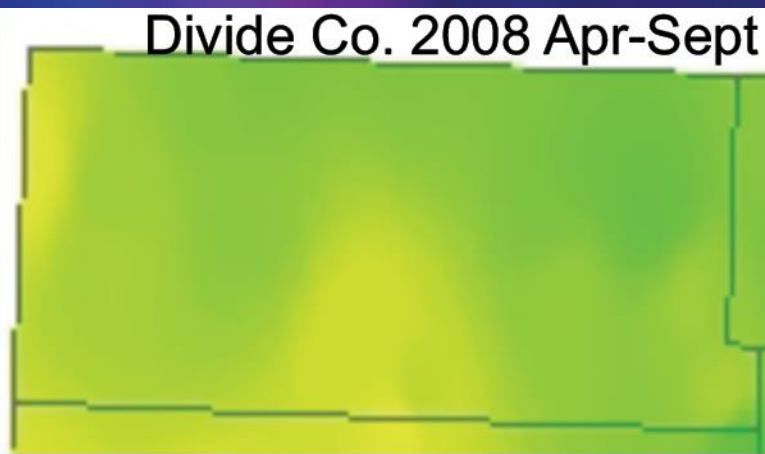
Divide Co. 2006 Apr-Sept



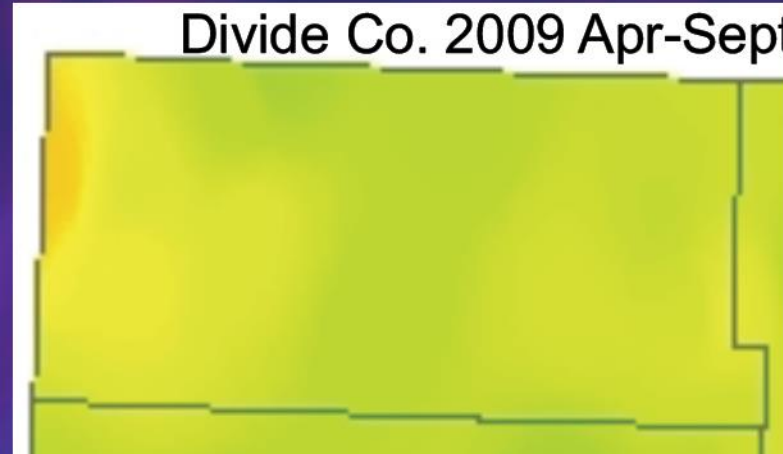
Divide Co. 2007 Apr-Sept



Divide Co. 2008 Apr-Sept



Divide Co. 2009 Apr-Sept

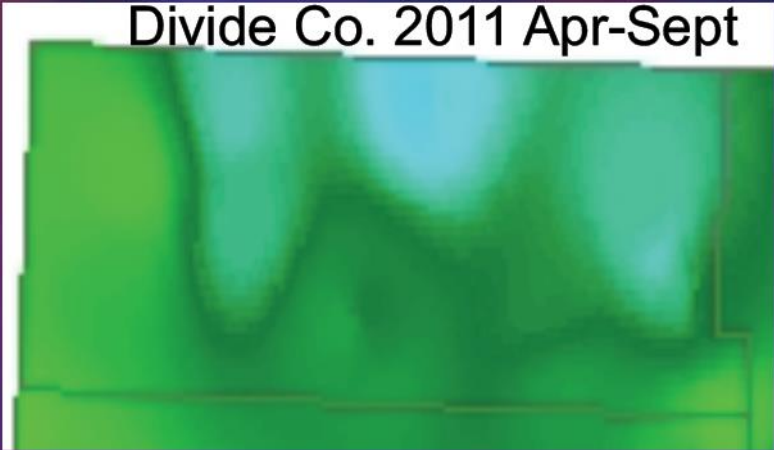


ARB Precipitation Monitoring Maps

Divide Co. 2010 Apr-Sept



Divide Co. 2011 Apr-Sept



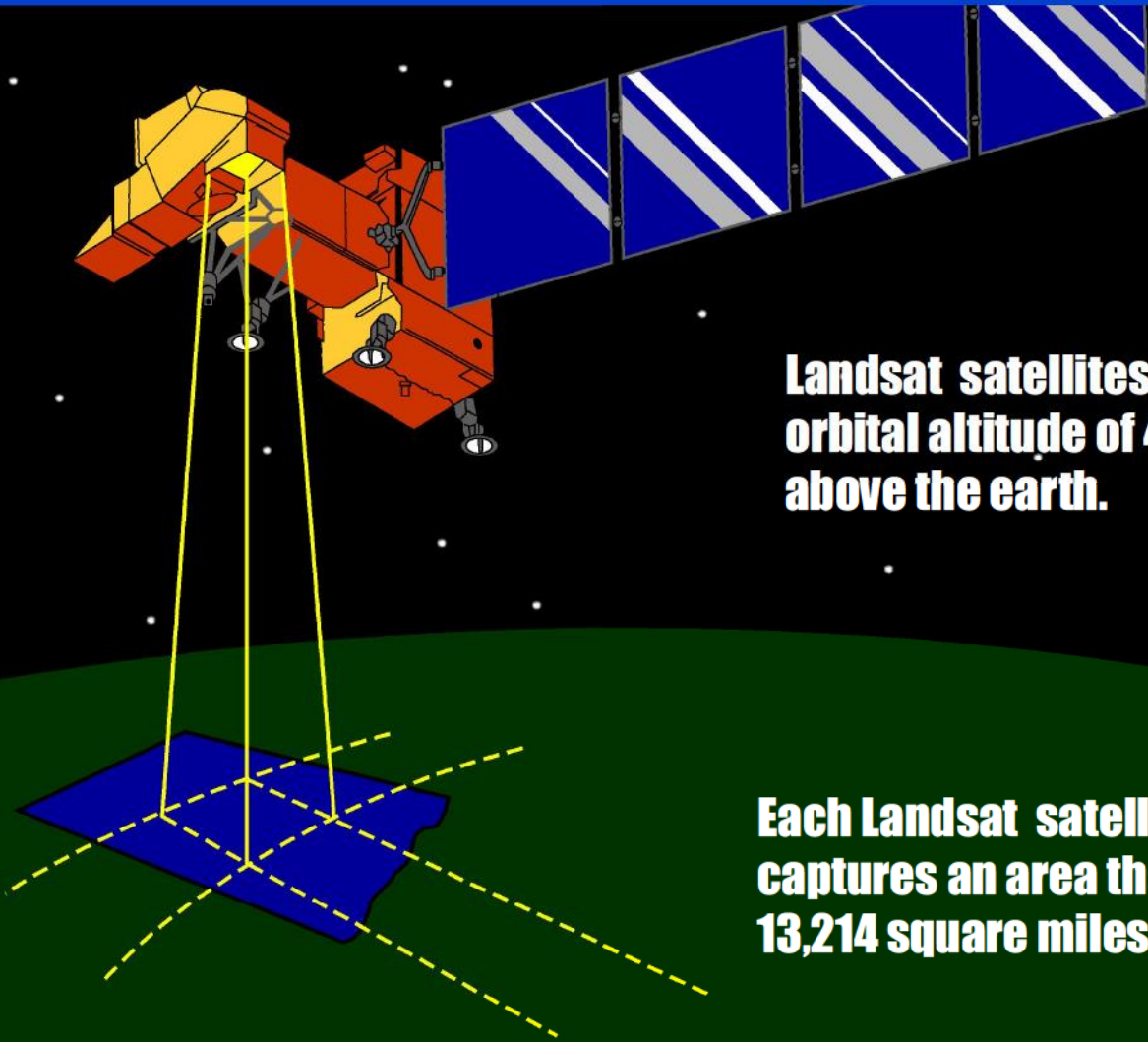
Divide Co. 2012 Apr-Sept



Divide Co. 2013 Apr-Sept



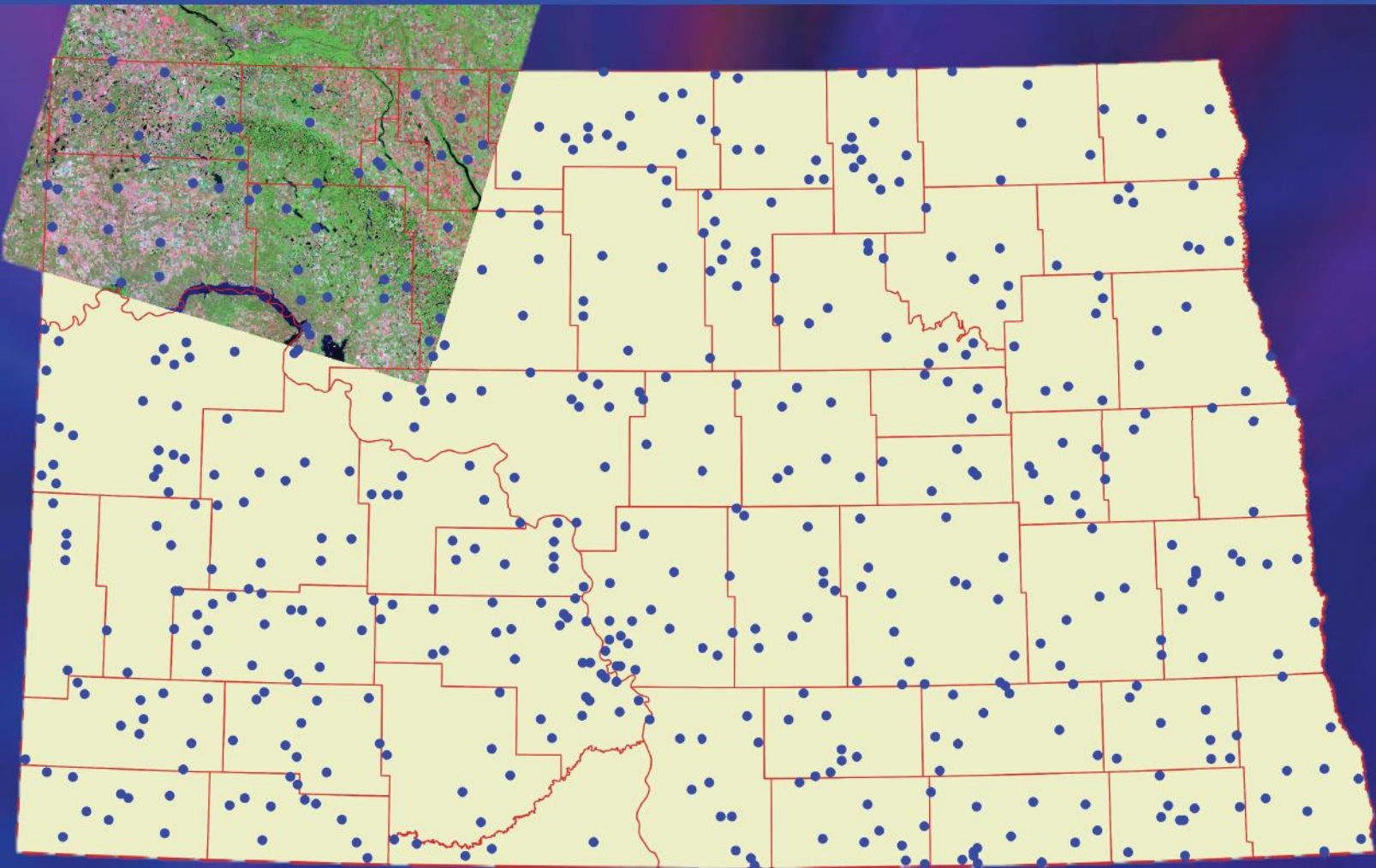
Landsat Water Resource Monitoring



Landsat satellites have an orbital altitude of 438 miles above the earth.

Each Landsat satellite scene captures an area that covers 13,214 square miles.

Landsat Water Resource Monitoring



Landsat Water Resource Monitoring

- **Divide County**
- **Landsat Years : 2006 - 2009 - 2013**
- **Landsat Methods:**

Band combinations of 7-4-2 (7-5-3)

ISODATA Classification

Water Area Extraction

Divide Co. Landsat on Sept. 30, 2006

Bands 7-4-2 : Open water is black



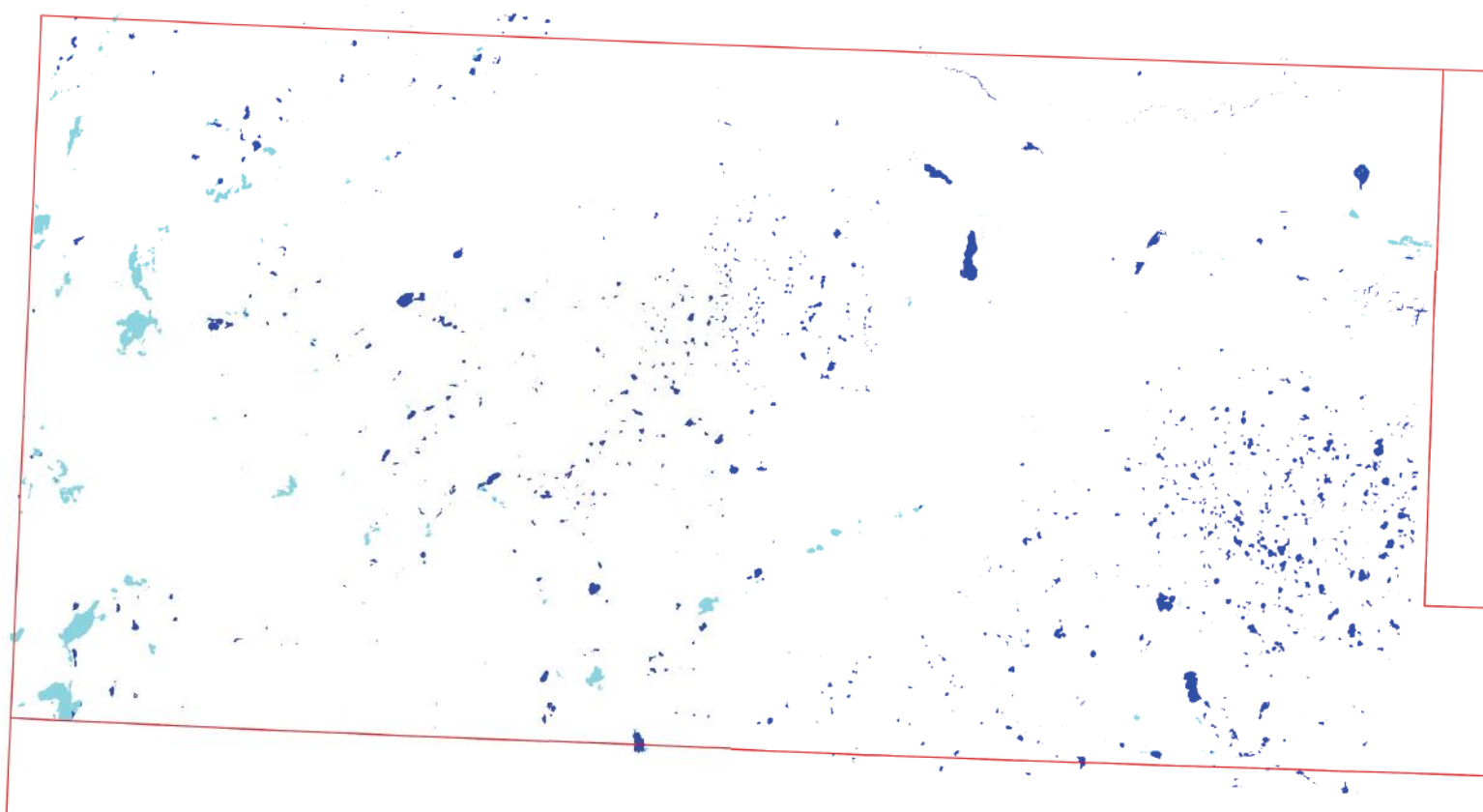
Divide Co. Landsat on Sept. 30, 2006

Classification of Open Water : Dark Blue



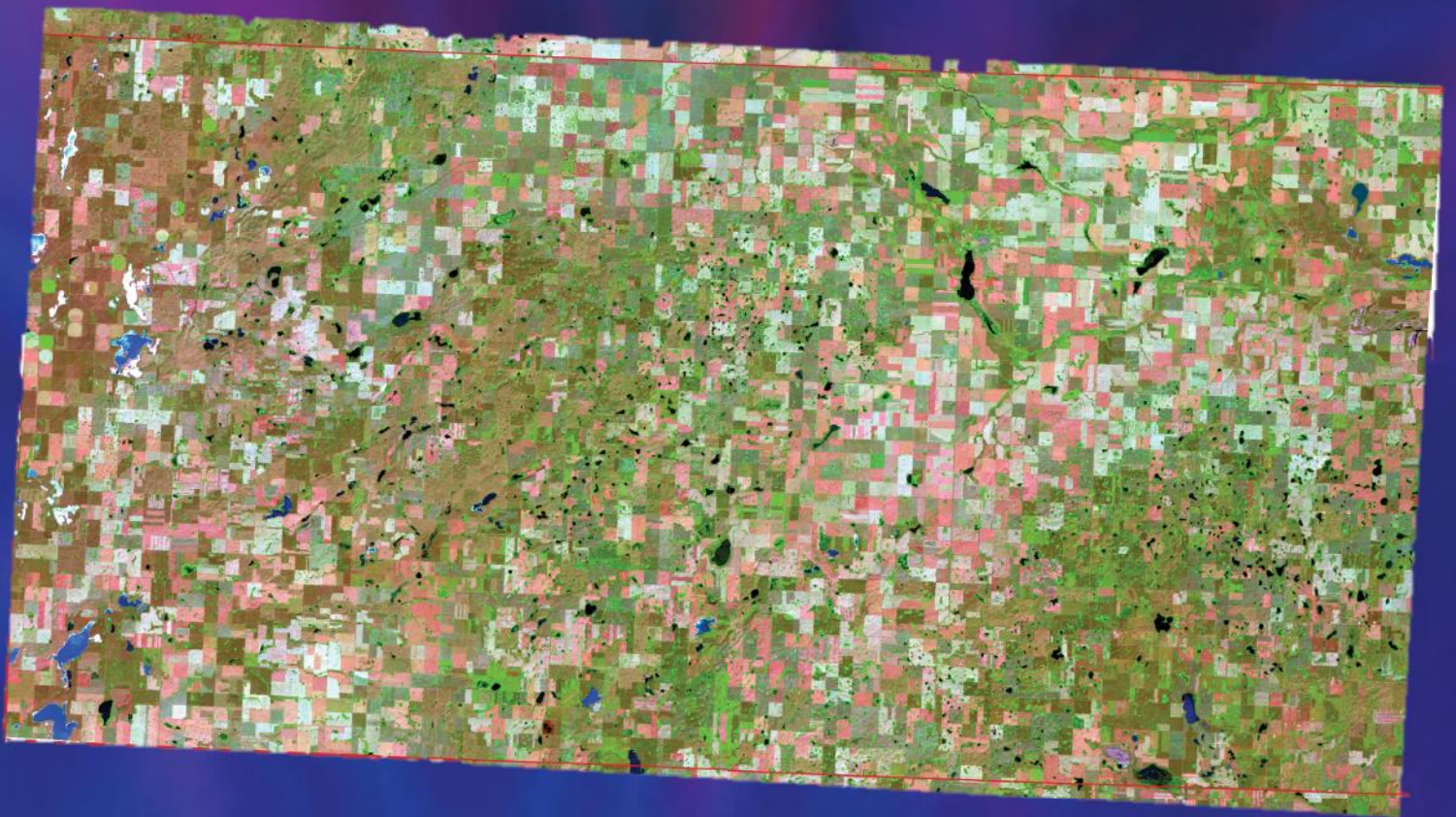
Divide Co. Landsat on Sept. 30, 2006

Extraction of Open Water : ~ 14 Sq. Miles



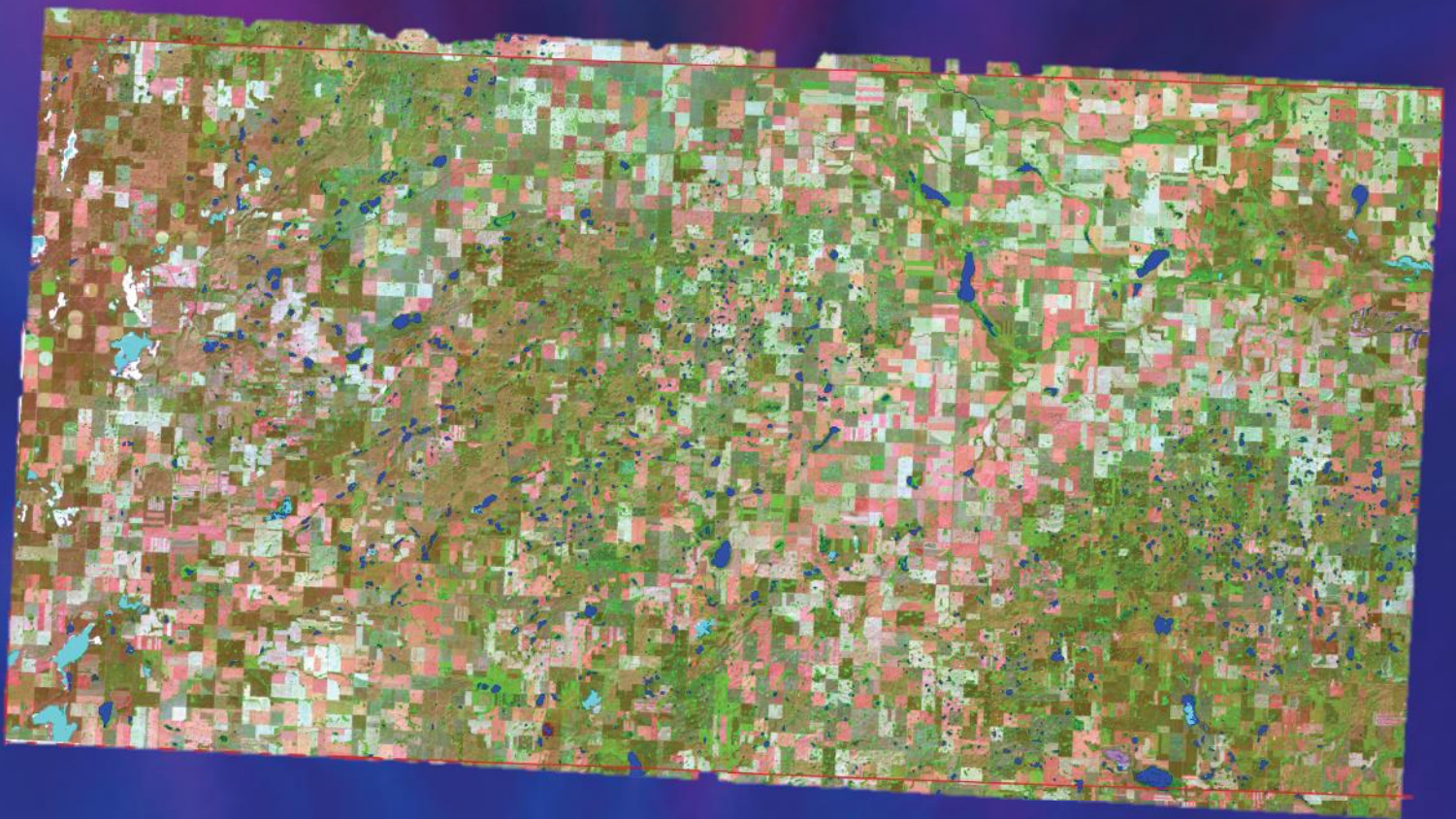
Divide Co. Landsat on Sept. 22, 2009

Bands 7-4-2 : Open water is black



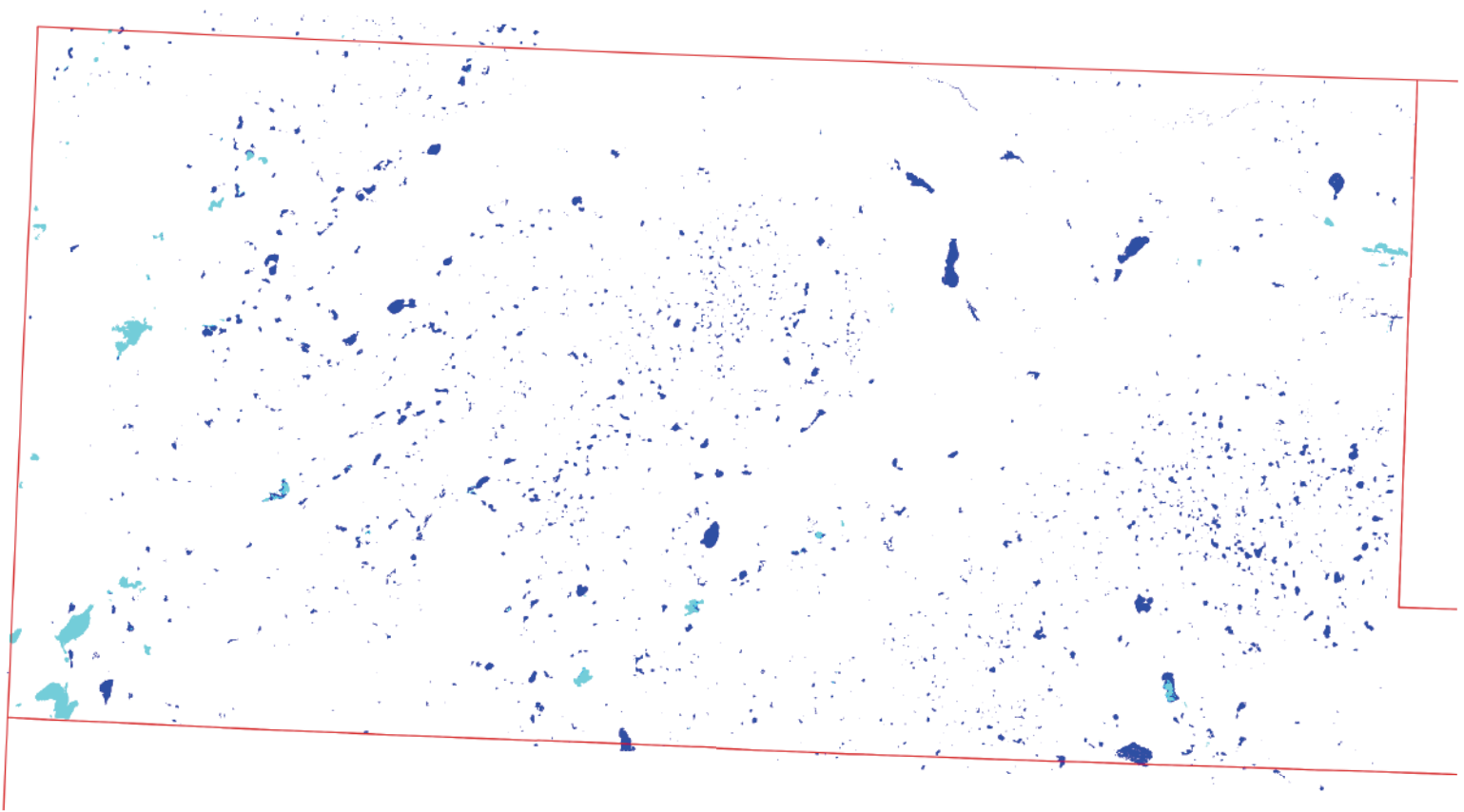
Divide Co. Landsat on Sept. 22, 2009

Classification of Open Water : Dark Blue



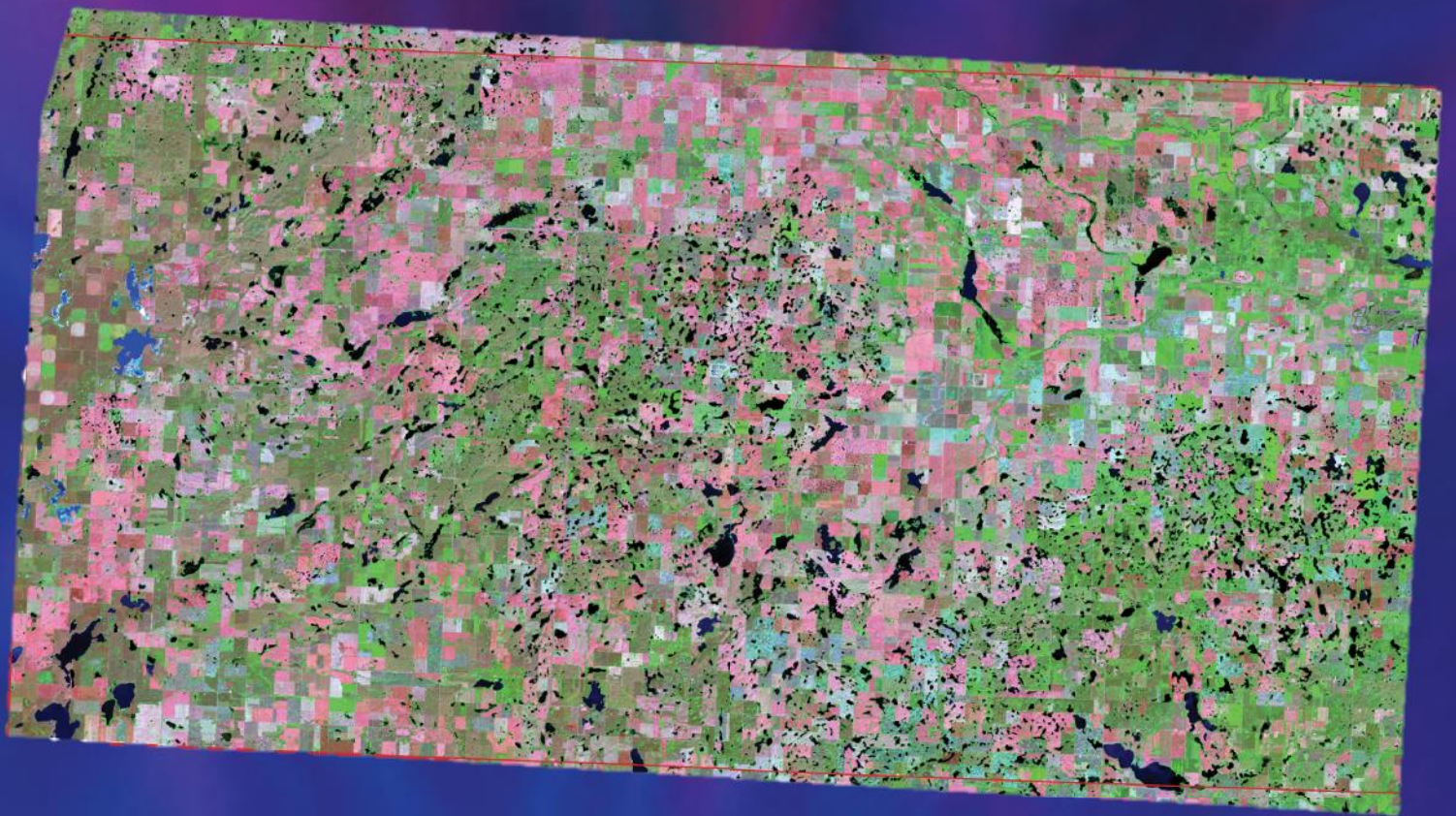
Divide Co. Landsat on Sept. 22, 2009

Extraction of Open Water : ~ 20 Sq. Miles



Divide Co. Landsat on Sept. 17, 2013

Bands 7-5-3 : Open water is black



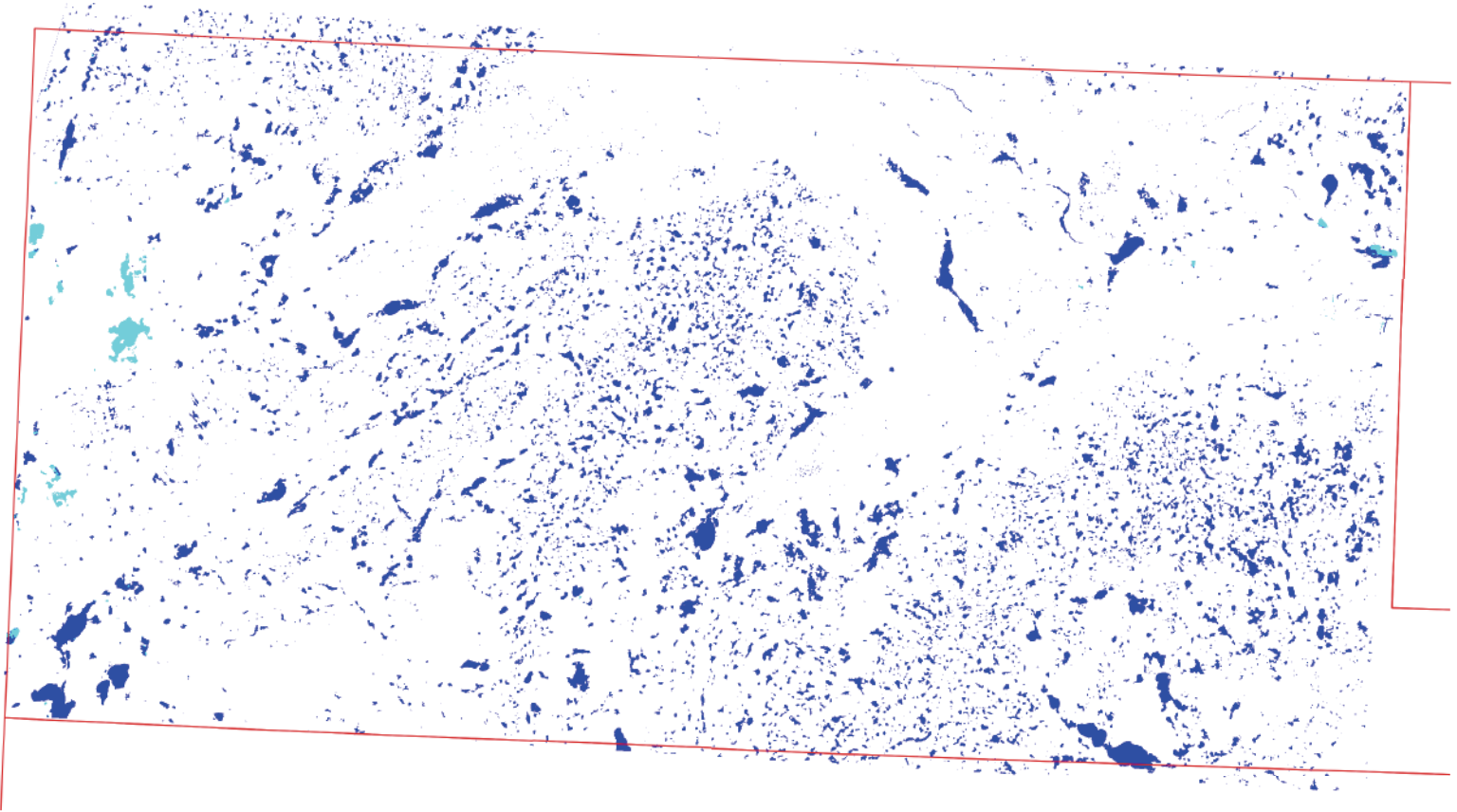
Divide Co. Landsat on Sept. 17, 2013

Classification of Open Water : Dark Blue



Divide Co. Landsat on Sept. 17, 2013

Extraction of Open Water : ~ 83 Sq. Miles



Landsat Water Resource Monitoring

- **Square Miles of Open Surface Water Areas**

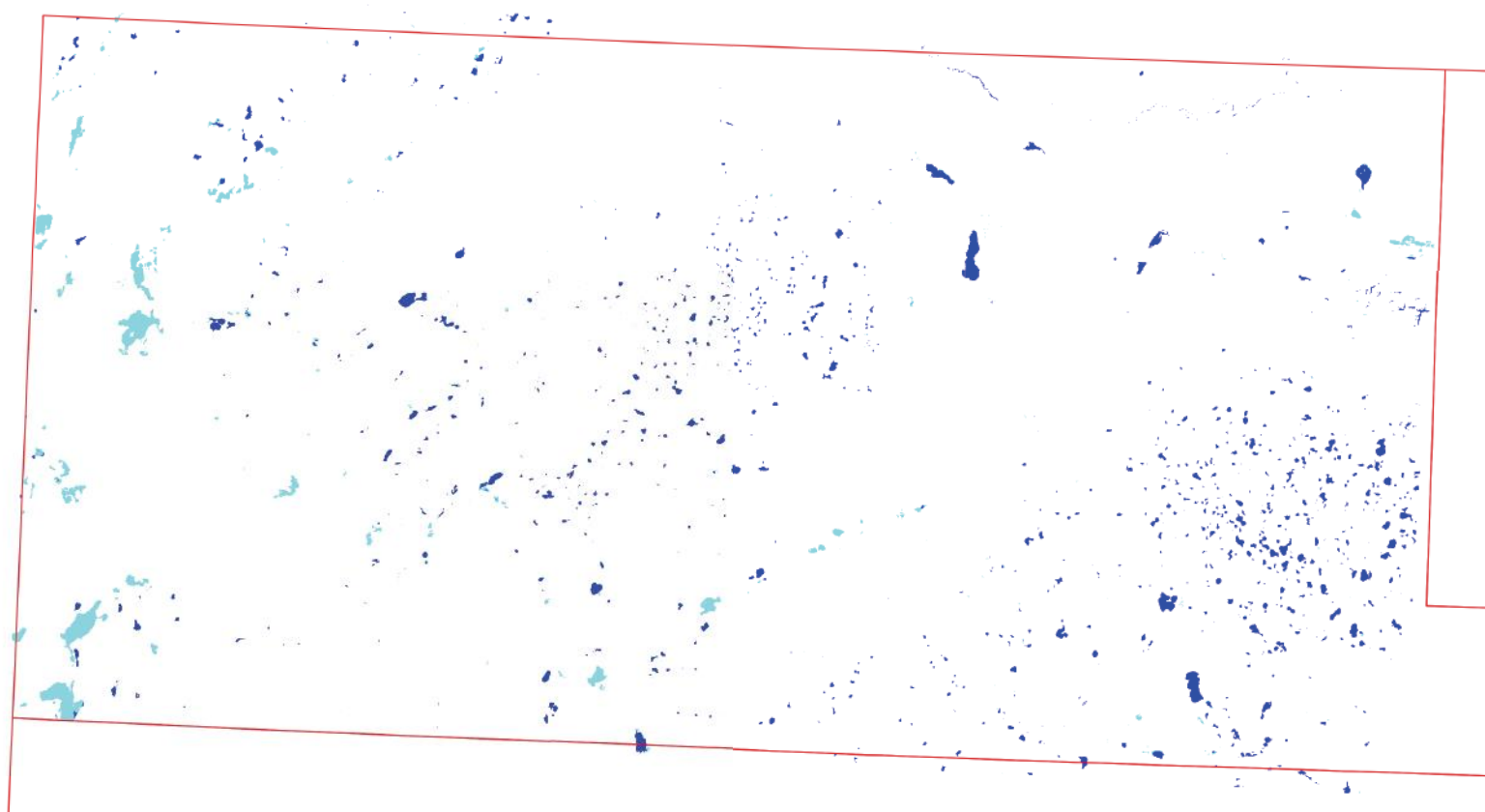
Year of 2006 ~ 14 Sq. Miles

Year of 2009 ~ 20 Sq. Miles

Year of 2013 ~ 83 Sq. Miles

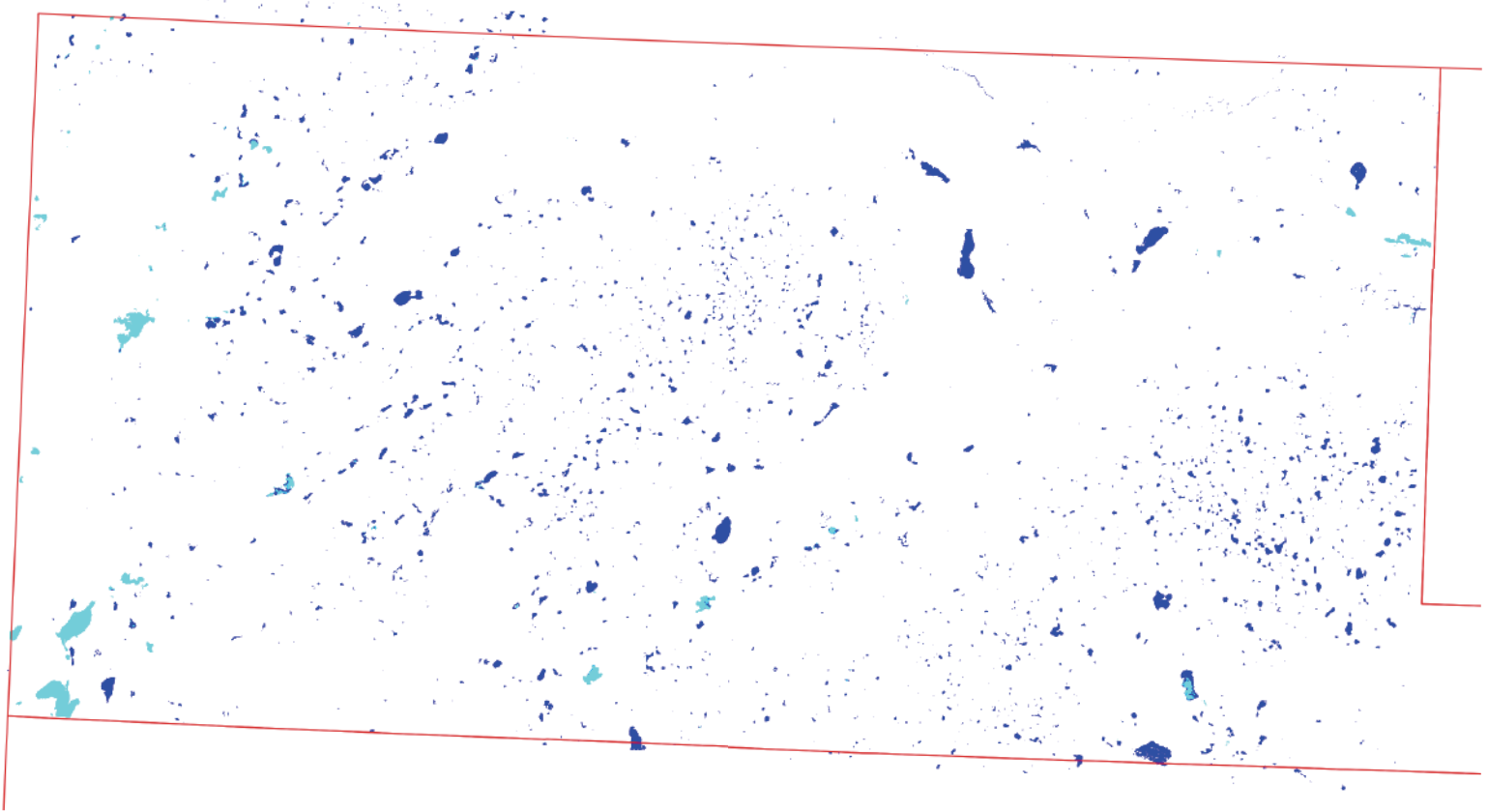
Divide Co. Landsat on Sept. 30, 2006

Extraction of Open Water : ~ 14 Sq. Miles



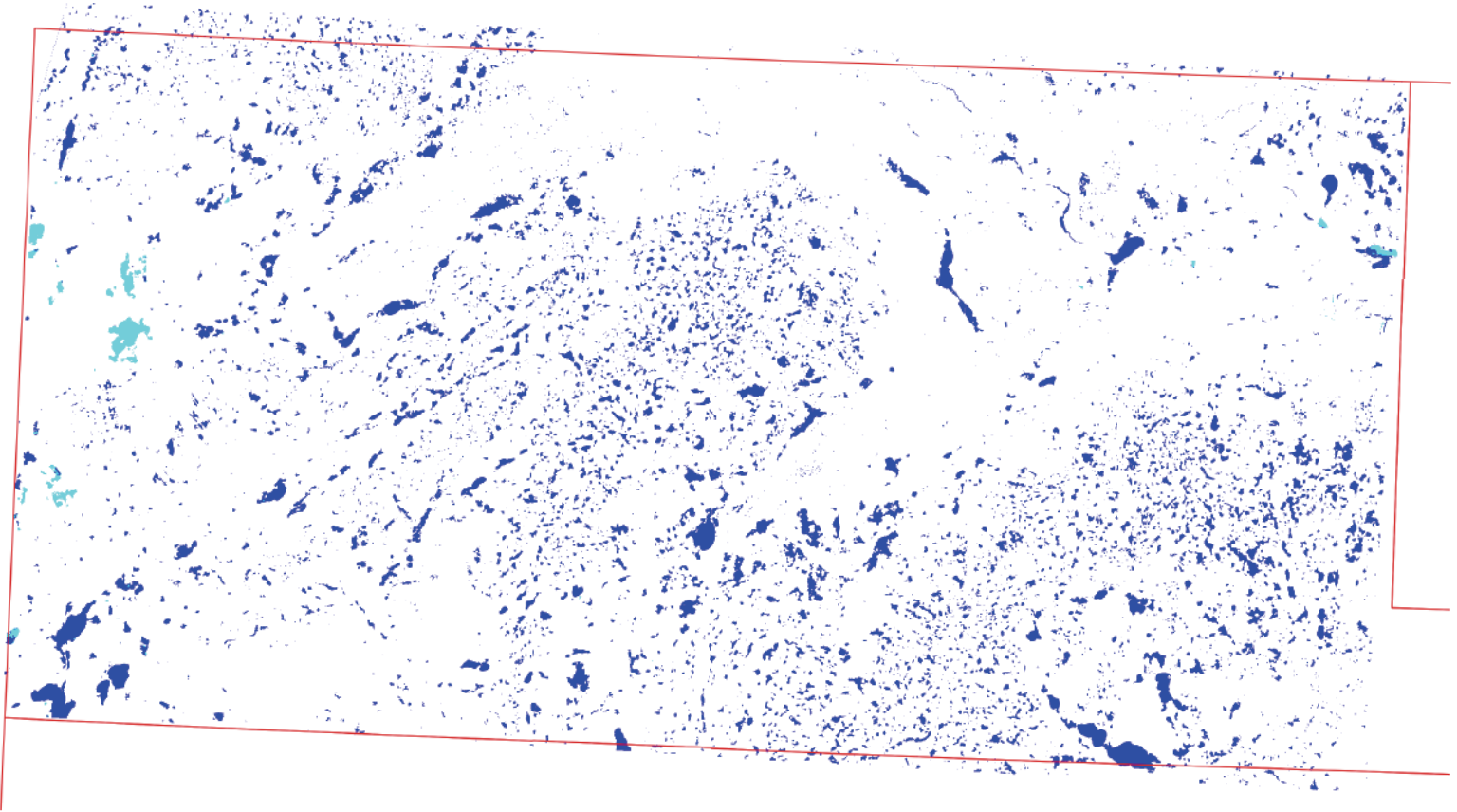
Divide Co. Landsat on Sept. 22, 2009

Extraction of Open Water : ~ 20 Sq. Miles



Divide Co. Landsat on Sept. 17, 2013

Extraction of Open Water : ~ 83 Sq. Miles



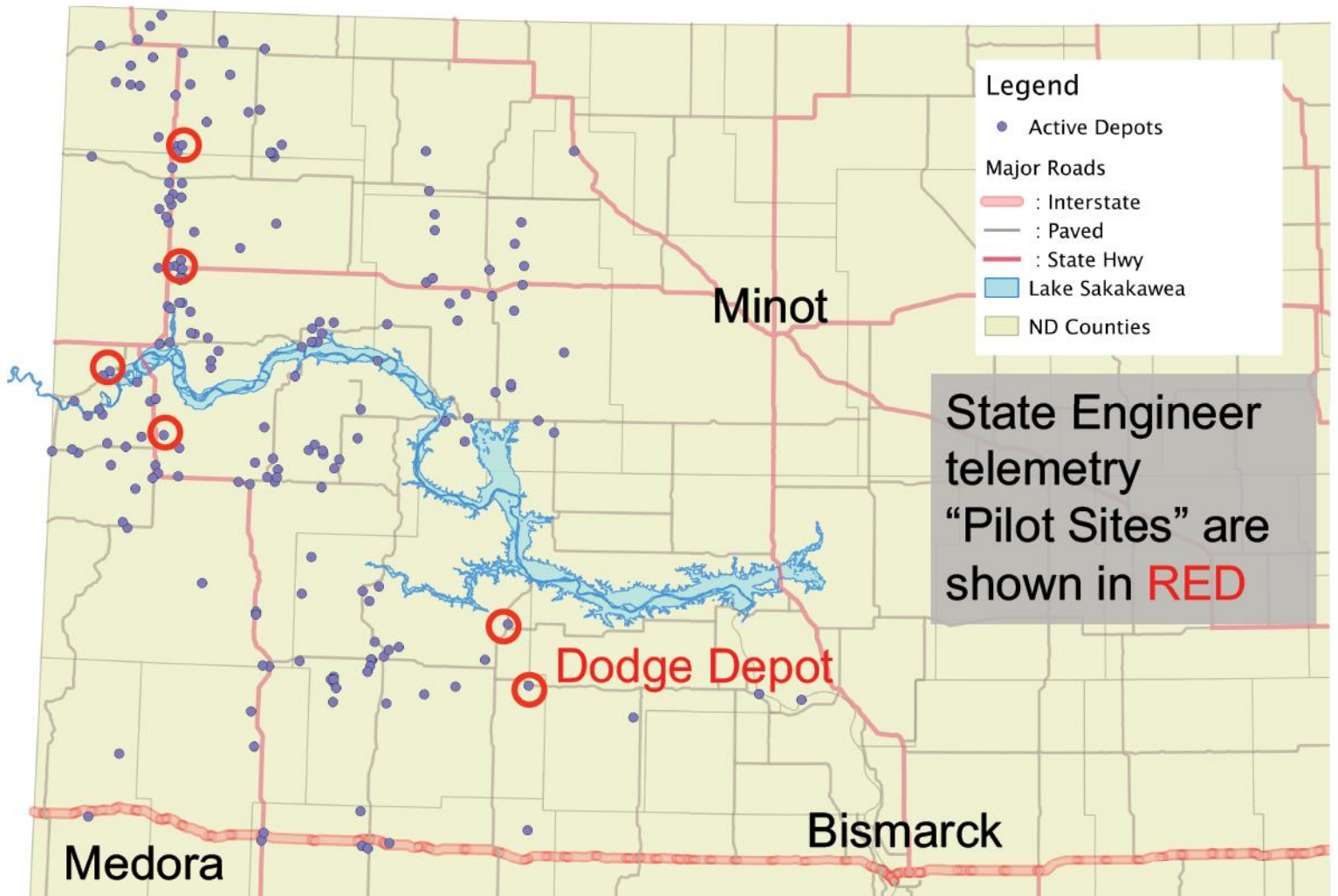
Water Use & Telemetry History

State Engineer Water Use Monitoring.

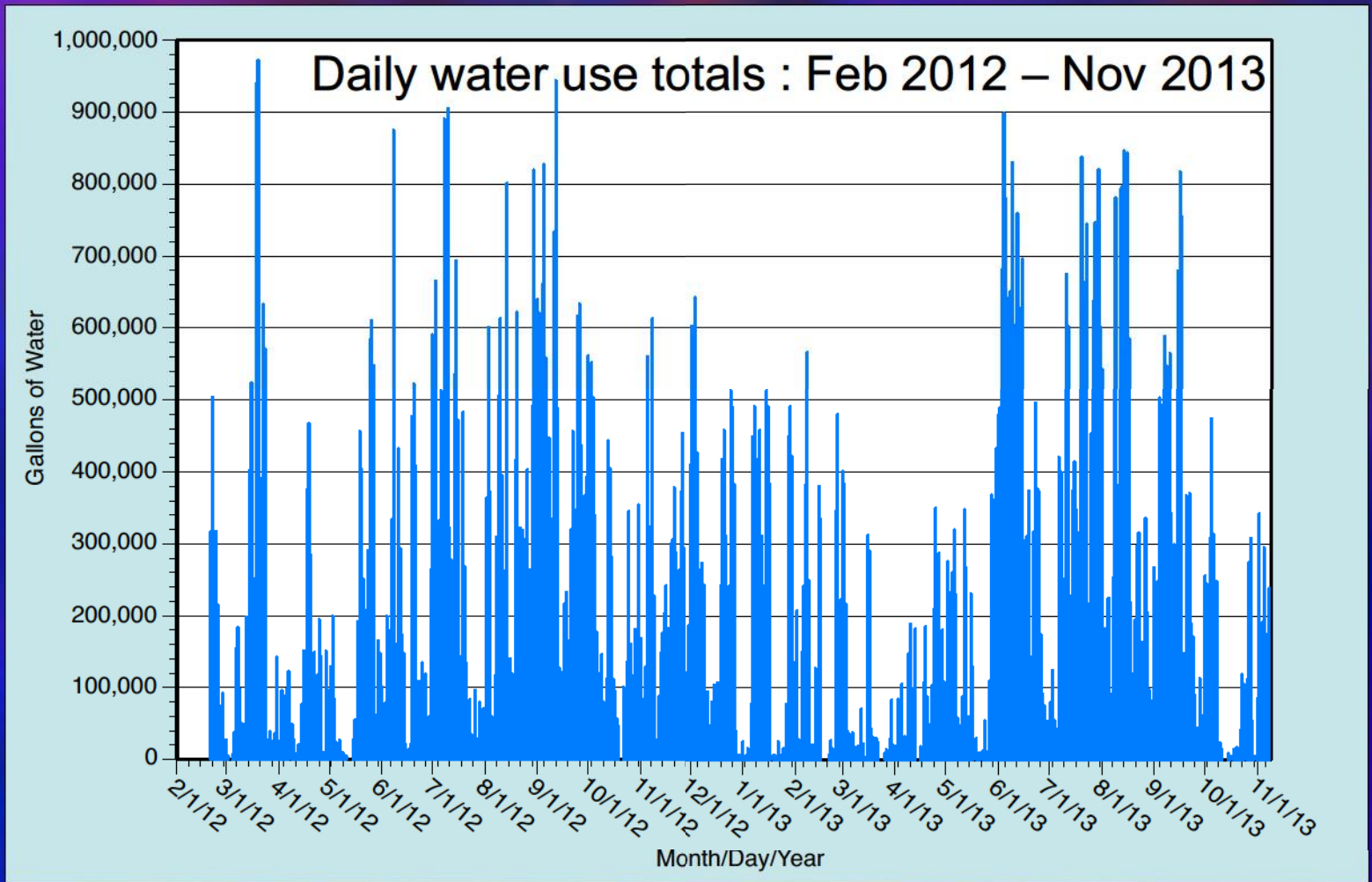
Statute requires annual reporting , which has been enhanced by:

- 1. Increased frequency of meter readings by staff**
- 2. Develop monthly meter reports for permit holder**
- 3. Implemented a telemetry pilot study**

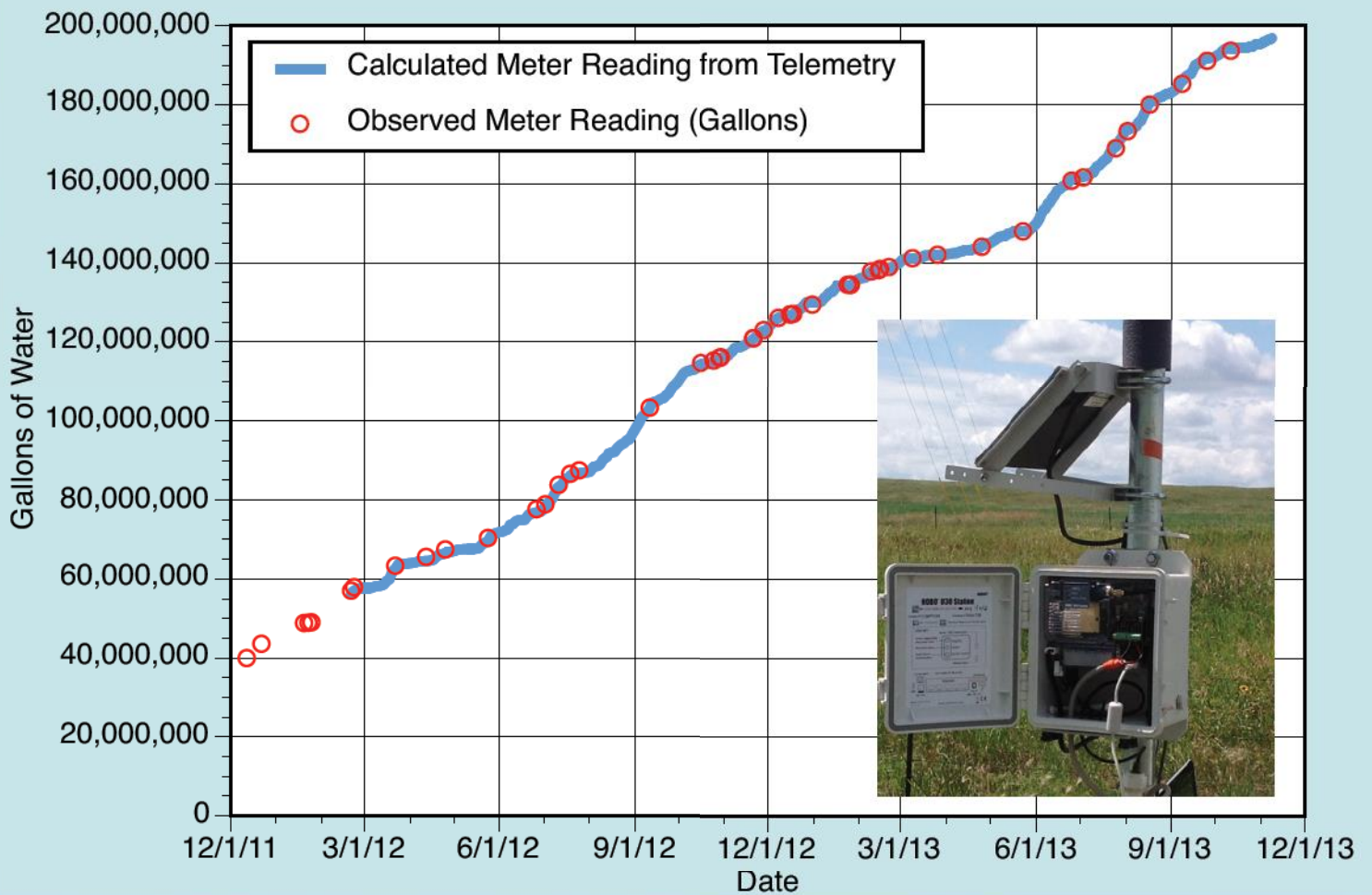
Water Depots & Pilot Sites



Dodge Depot Telemetry : Daily Totals



Dodge Depot Telemetry : Running Sum



Telemetry : Data : ? - ? : Database

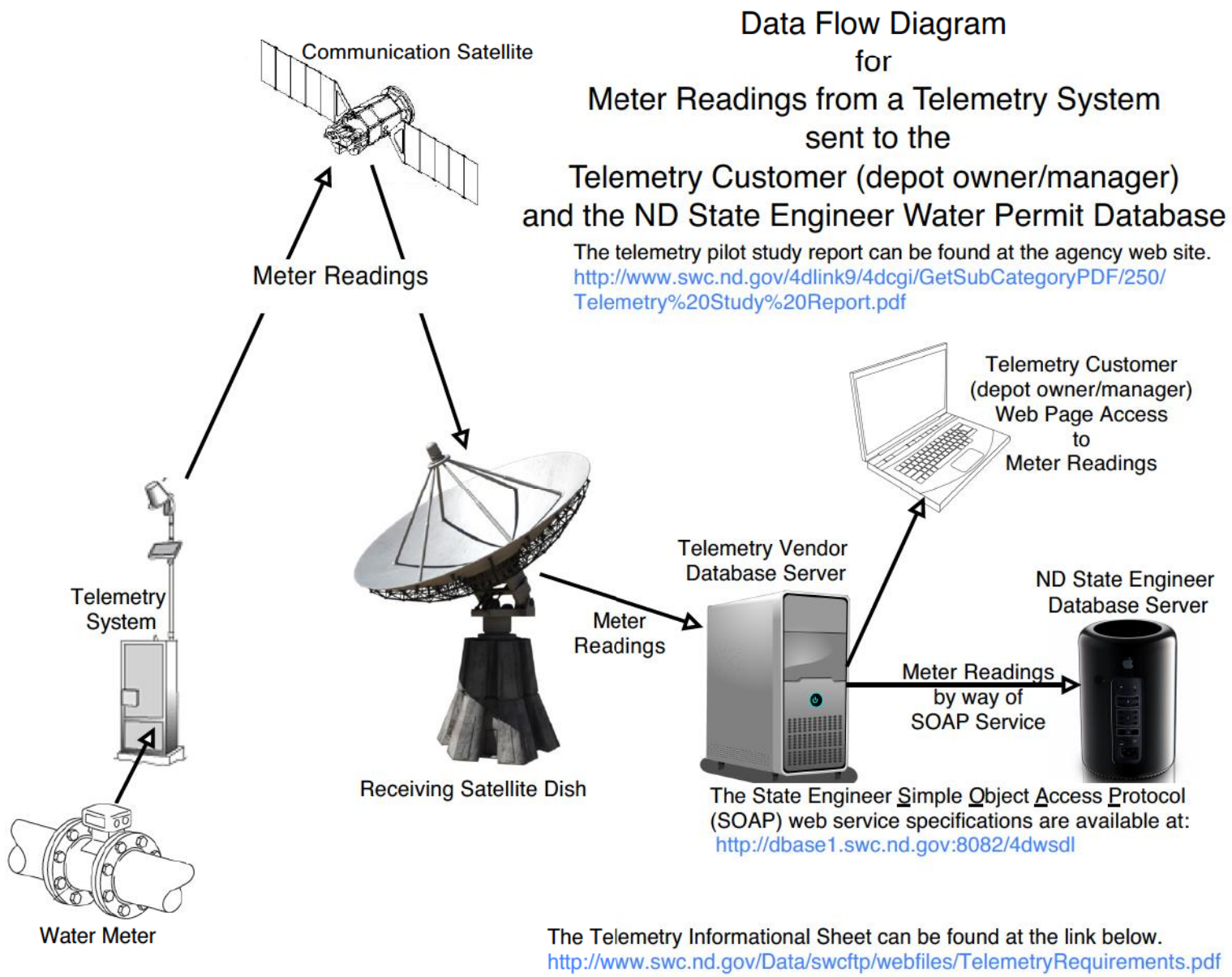
How did we make this connection?

Telemetry : Data : SOAP : Database

The SOAP connection

SOAP Service developed by agency I.T. - Chris Bader

- **SOAP (Simple Object Access Protocol)**
 - **Open Standard Web Service (XML)**
 - **Hardware and Software Independent**



Telemetry : Data : SOAP : Database

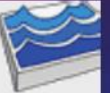
The SOAP connection

- **Telemetry Hardware becomes “Transparent”**
- **Data is “pushed” to the agency database**
 - **Savages Industries (Ames Water)**
 - **IDT (South Dakota)**
 - **McCrometer**
 - **Halverson Services**
 - **Preferred Controls**

Water Depot Database - SOAP

Water Depot : Schaper (J and L Water) Depot

Depot Index : 22



Depot Info | History | Documents

Name : Schaper (J and L Water) Depot

Location : 14609120AADA

Long, Lat : -102.29089, 47.45593

X-Coord, Y-Coord : 1,525,486, 657,601

Contact : Jim Schaper

[Modify Credentials](#)

[Send Credentials](#)

Address 1 : 279 Hwy 8 N

Remote Login Enabled!

Address 2 :

City, State, Zip : Halliday

ND

58636-0000

Phone : (701) 938-4431

Cell Phone :

E-Mail : steve@ldt.us.com

County : Dunn

Status : Developed

Meter Station

	Location Name	Location	Model	Serial No	Meter Units
	South Fill Station	14609120AADA	T2AWWA Class I	75524755	Gallons
	North Fill Station	14609120AADA	T2AWWA Class I	75838666	Gallons

Water Depot Database - SOAP

• SOAP Credentials - auto sent by e-mail

- Station ID
- User Name
- Password

You can access the SOAP Telemetry information at
<http://www.swc.nd.gov/SWCTelemetrySOAPSPEC.html>
The Web Services specification can be accessed at
<http://dbase1.swc.nd.gov:8082/4dwsdl>

Following is summary information that will be required to set up the communication services on your meter equipment.

Depot Name : Johnsrud Water Depot
Depot ID : 40
Username : Johnsrud
Password : **XXXXXXXXXX**
Notification E-Mail : swcsoapnotify@nd.gov

Meter Station Information :

Station ID : 60
Location (TRS) : 15109831DDB
Location Name : North Power Fuels fill
Longitude : -103.26610
Latitude : 47.85066
Meter Name : McCrometer
Meter Model :
Meter Serial No : GP11-1940
Meter Units : Barrels
Meter Precision : 1

Water Depot Database - SOAP

Location Name :

Location : Long, Lat : -102.29089, 47.45593
X-Coord, Y-Coord : 1,525,483, 657,600

Meter Name :

Meter Model :

Meter Serial No :

Meter Units : Telemetry Required

Meter Precision :

Total Pumping for 2013 :

Meter Reading



Date	Time	Break	Reading	Observer Type	Comment
6/30/13	23:08:20	<input type="checkbox"/>	64783372	SOAP Service	
6/29/13	23:08:32	<input type="checkbox"/>	64706224	SOAP Service	
6/28/13	23:08:20	<input type="checkbox"/>	64480362	SOAP Service	
6/27/13	23:08:30	<input type="checkbox"/>	64260253	SOAP Service	
6/26/13	23:08:22	<input type="checkbox"/>	64001943	SOAP Service	
6/26/13	18:26:00	<input type="checkbox"/>	63919484	State Personnel	
6/25/13	23:08:22	<input type="checkbox"/>	63785016	SOAP Service	
6/24/13	23:08:32	<input type="checkbox"/>	63719933	SOAP Service	
6/1/13	14:00:00	<input type="checkbox"/>	61957504	Permit Holder	Same as telemetry.
5/1/13	11:00:00	<input type="checkbox"/>	58256286	Permit Holder	Same as telemetry.

Water Depot Database - SOAP

Name	Depot ID	Depot Approp	Status	Station ID	Location	Meter	Model	Units	Date	Reading	Elapsed Days
▼ Pennington-Ames Depot (New Town)											
	63	200.0	●	88	15109204CCCC	McCrometer	FC100-02-K	Barrels	9/12/13	3086763	1
	63	200.0	●	89	15109204CCCC	McCrometer	FC100-02-K	Barrels	9/12/13	3041080	1
▼ Bratcher-Ames (Timber Creek) Depot											
	50	120.0	●	29	15110109CAAC	McCrometer MI	FC100-02-K	Barrels	9/12/13	833107	1
	50	120.0	●	30	15110109CAAC	McCrometer MI	FC100-02-K	Barrels	9/6/13	718527	7
	50	125.0	●	111	15110109CAAC	McCrometer	FC100-02-K	Barrels	9/12/13	648056	1
	50	125.0	●	112	15110109CAAC	McCrometer	FC100-02-K	Barrels	9/6/13	471407	7
▼ Dwyer, Michael water depot											
	43	284.4	●	97	15110220DDCB	McCrometer	McCrometer	Barrels	9/13/13	409680	0
▼ Reistad-Ames (Westby) Water Depot											
	39	284.4	●	23	16310234CBBC	McCrometer	MF-106	Barrels	8/28/13	707803	3
	39	113.5	●	24	16310234CBBC	McCrometer	MF-106	Barrels	9/12/13	634559	1
▼ Wurtz & Ames Parshall Depot											
	26	113.5	●	31	15209015CCCC	McCrometer	FC100-02-K	Barrels	9/12/13	296079	1
	26	495.7	●	32	15209015CCCC	McCrometer	FC100-02-K	Barrels	9/12/13	421925	1
▼ Schaper (J and L Water) Depot											
	22	495.7	●	20	14609120AADA	Sensus	T2AWWA Class I	Gallons	9/12/13	2330658	1
	22	200.0	●	21	14609120AADA	Sensus	T2AWWA Class I	Gallons	9/12/13	2389391	1
▼ Jensen (Clearwater) Water Depot											
	18	200.0	●	14	15709035DDC	McCrometer	ML106-00	Barrels	9/5/13	0	8
	18	729.5	●	15	15709035DDC	McCrometer	ML106-00	Barrels	9/13/13	0	0
▼ Sheldon-Ames Water Depot											
	11	729.5	●	48	15409618ADAAB	McCrometer	FC100-02M	Barrels	9/12/13	1372506	1
	11	729.5	●	49	15409618ADAAB	McCrometer	FC100-02-M	Barrels	9/12/13	212141	1

Conclusions

- Water Depot Use :

Rapid increase from 2010-2012, slowing in 2013.

Average Frac water use ~ 8.5 Acre-Feet

- Real-Time Water Use (Telemetry – SOAP):

SOAP service completed within existing budgets.

Agency IT staff knowledge of workflow key factor.

Queries from other States on SOAP implementation.

Private companies looking at our SOAP system.

Water Fracturing in the Bakken

Number of Days for a Hydraulic Fracture

