Addressing Groundwater Goals of the Missouri Regional Planning Area: Phase 2

Progress Report

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The University of Kansas

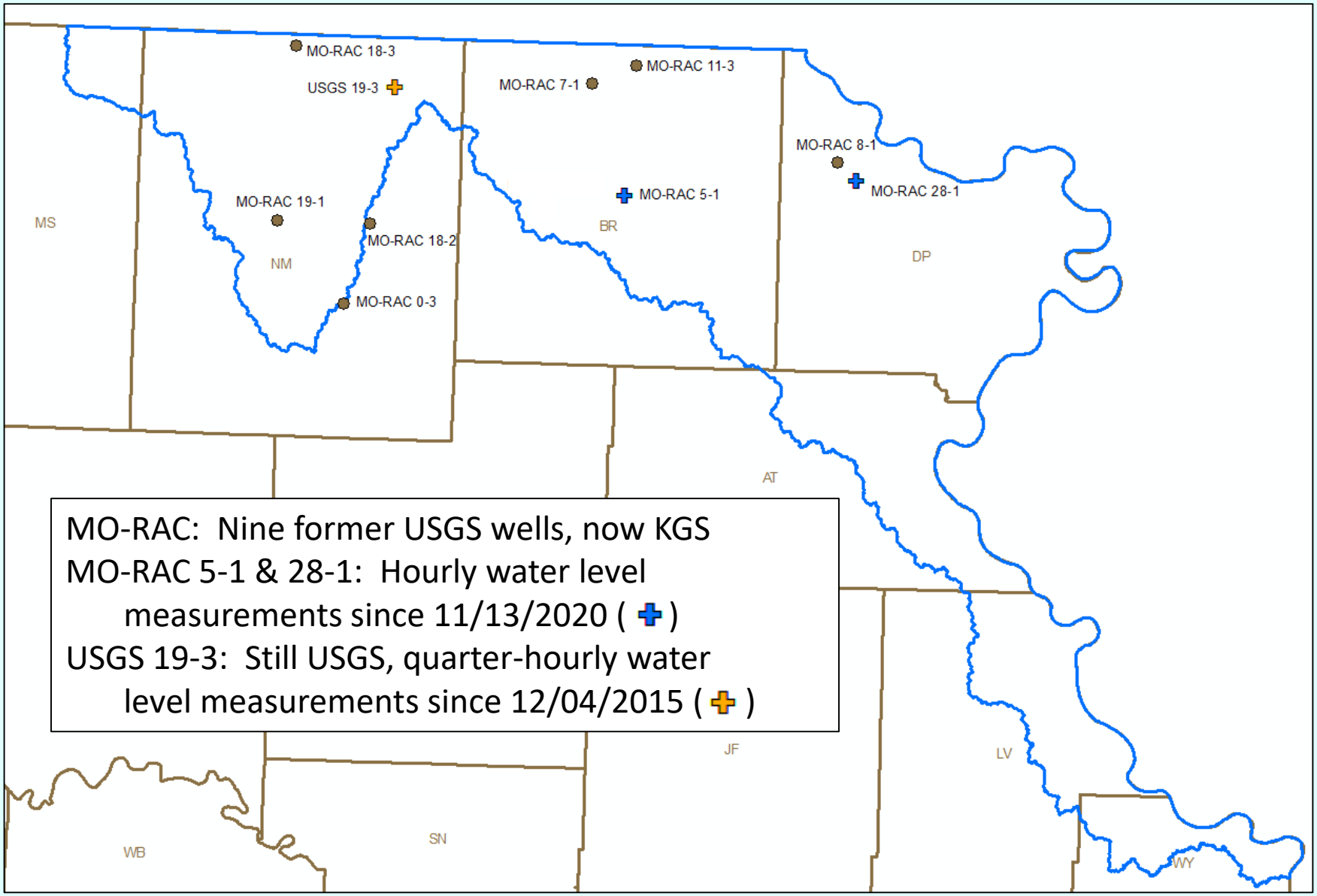
Phase 2 Objectives

- Establish a groundwater level and groundwater quality monitoring network in the Missouri Regional Planning Area (MRPA)
- Provide improved estimates of safe yield and establish a groundwater quality baseline

Progress since last report

1. Initiated continuous water level monitoring in two of the former USGS wells
2. Collected additional manual water level measurements and chemical samples in former USGS wells
3. Collected samples from three Hiawatha municipal wells and compared nitrate levels in those wells to earlier nitrate levels in other Hiawatha wells

Well Locations

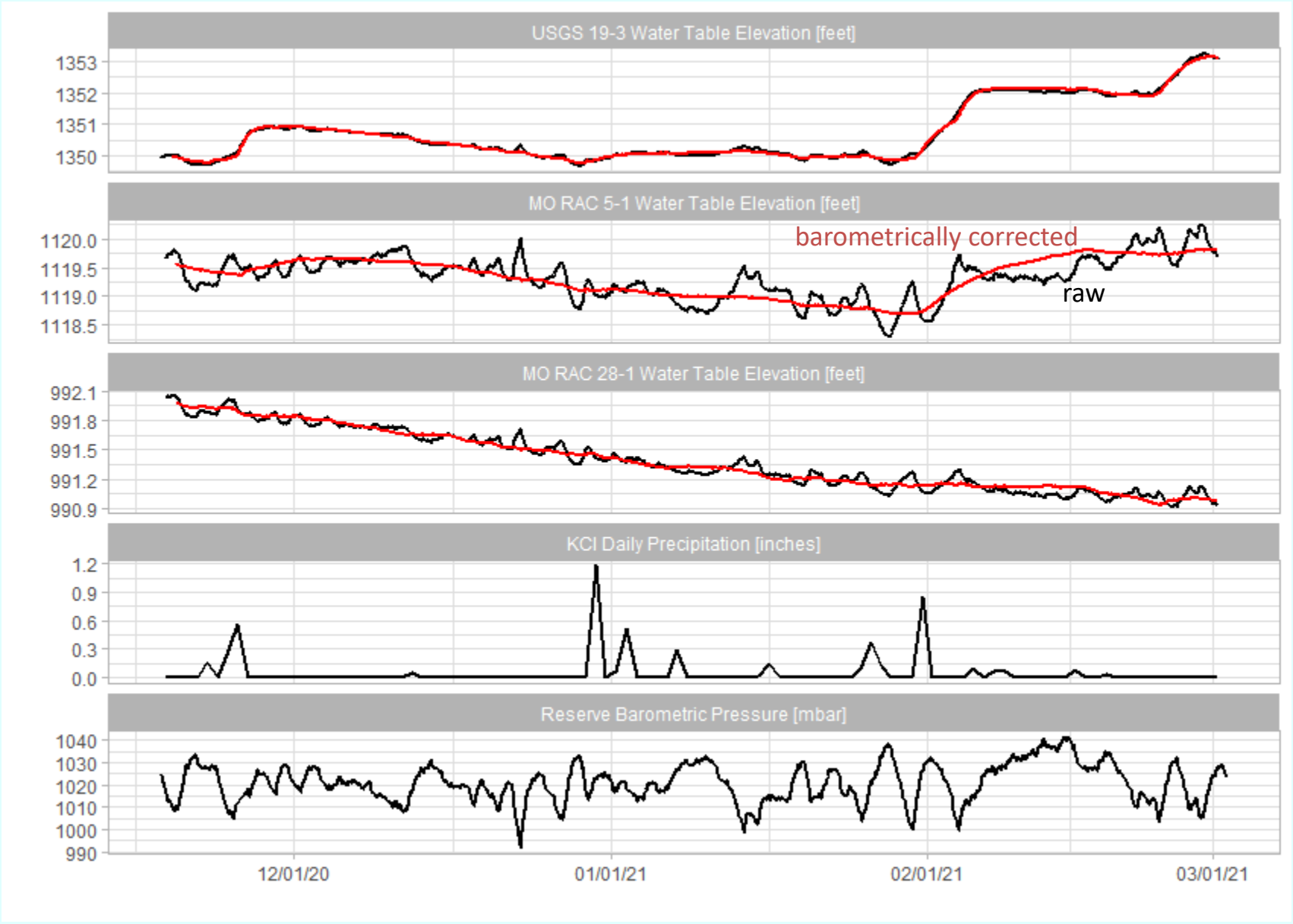


MO-RAC: Nine former USGS wells, now KGS

MO-RAC 5-1 & 28-1: Hourly water level measurements since 11/13/2020 (✚)

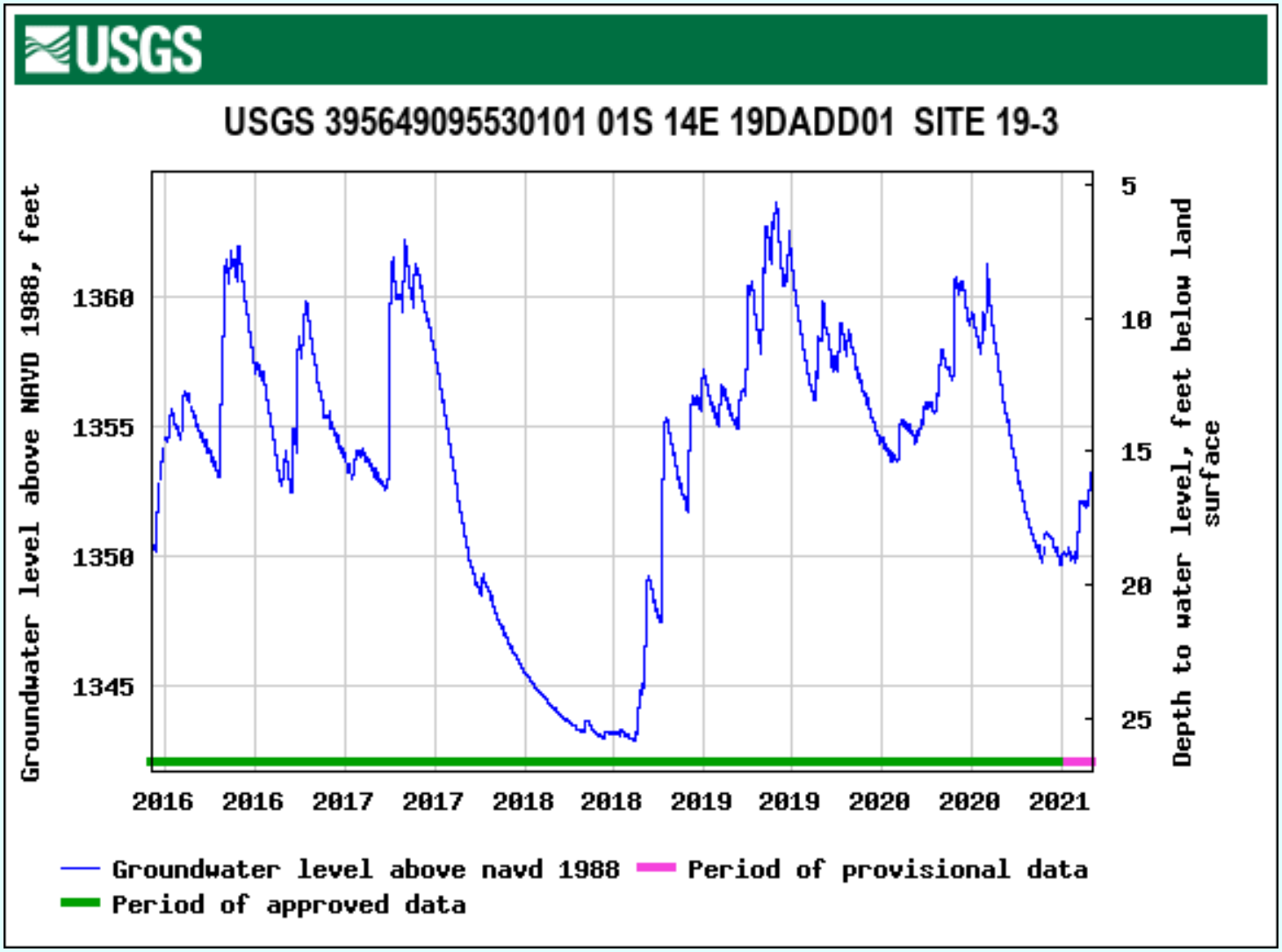
USGS 19-3: Still USGS, quarter-hourly water level measurements since 12/04/2015 (✚)

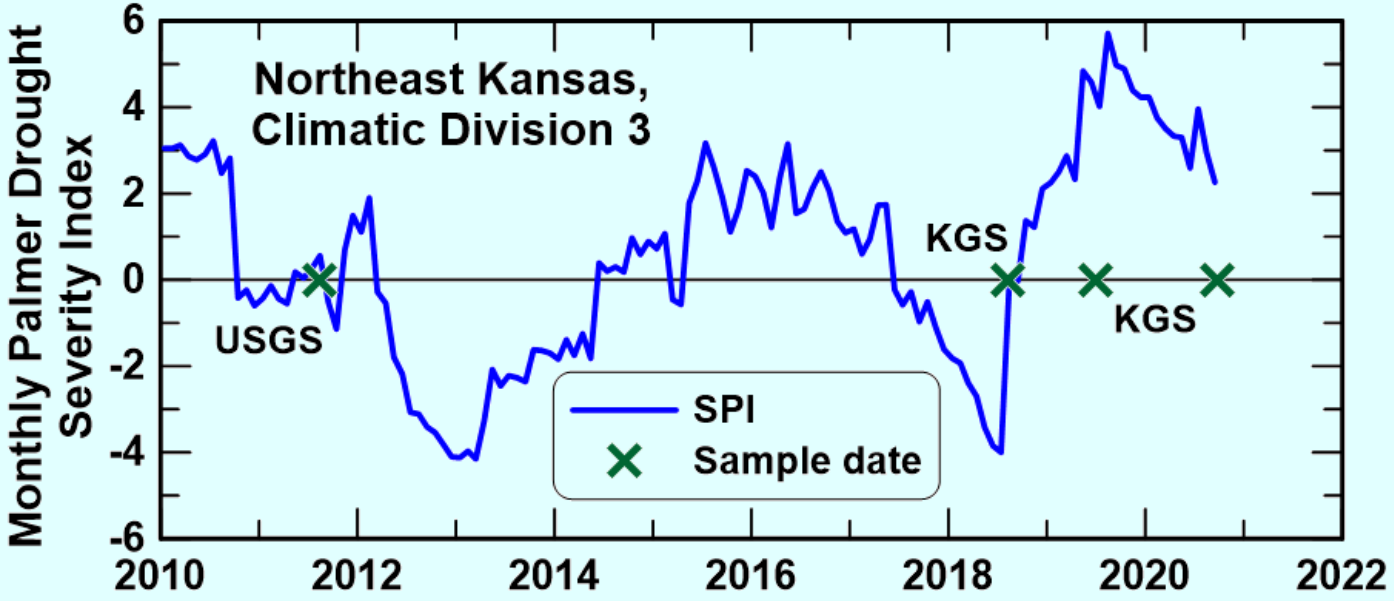
Continuous Measurements 11/18/20 – 3/1/21



Complete Record at USGS 19-3

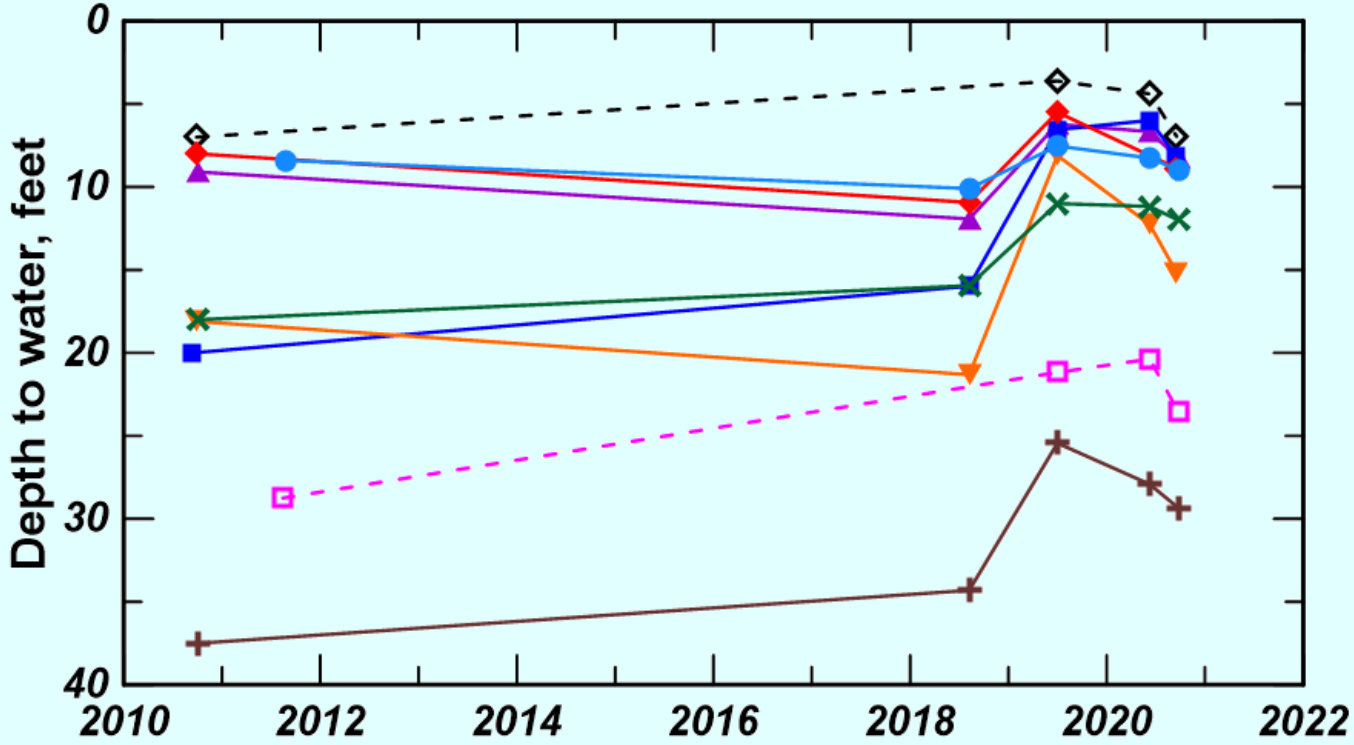
Northeast Nemaha County





Climate Conditions and Sampling Dates

Positive values indicate wetter than normal; negative values drier than normal.



Changes in Water Levels

Monitoring Well Water Quality for Doniphan and Brown Counties

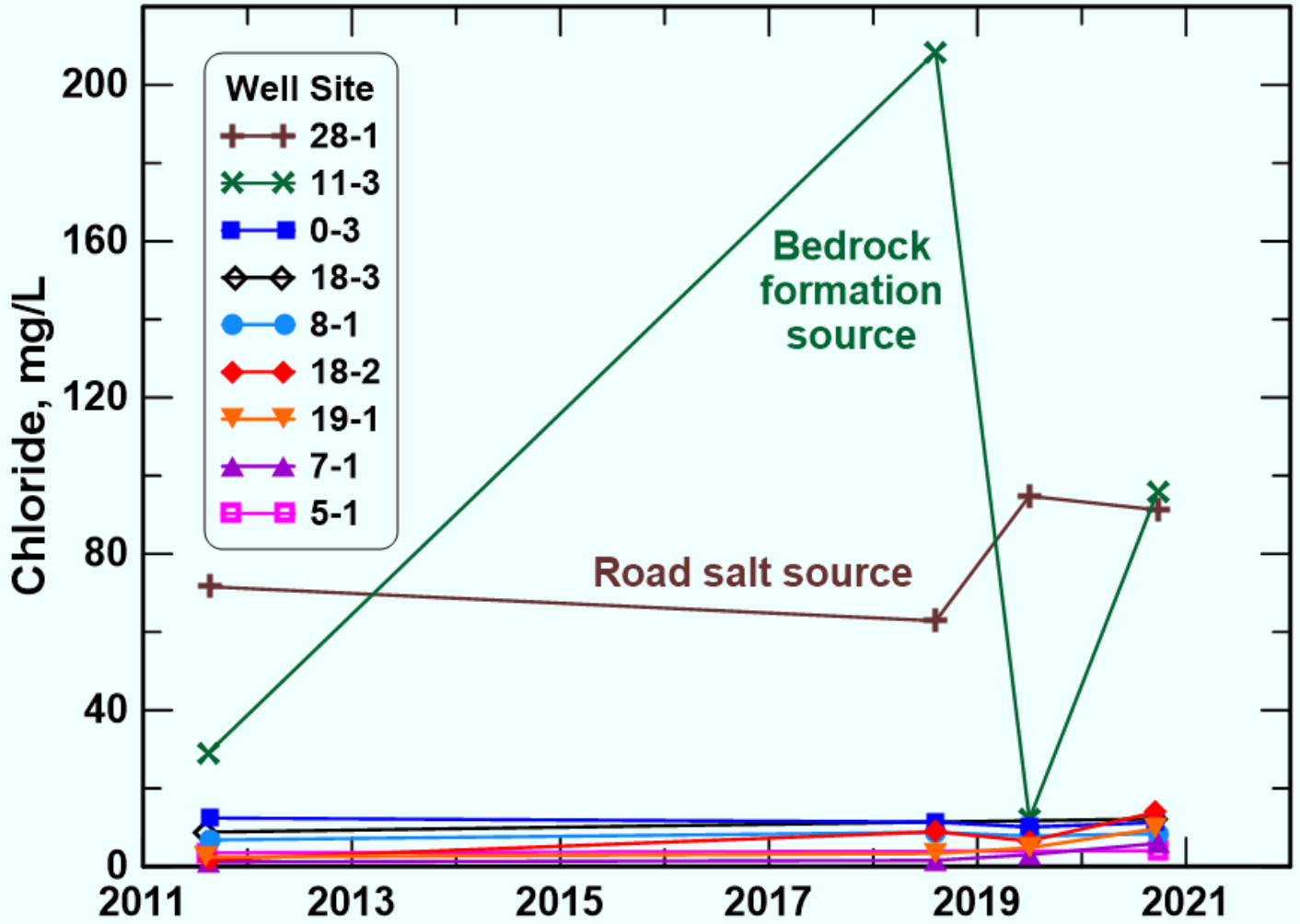
Site	Location	Co.	Depth well, ft	Date	Lab	Sp.C. µS/cm	Cl mg/L	SO_4 mg/L	NO_3-N mg/L
8-1	02S-19E-14BDCD	DP	38	8/24/2011	USGS	546	6.8	21.9	8.5
				8/8/2018	KGS	604	8.7	31.7	13.7
				7/2/2019	KGS	592	7.8	29.3	13.3
				9/23/2020	KGS	589	8.4	33.4	9.6
28-1	02S-19E-24DACC	DP	43	8/24/2011	USGS	861	71.6	17.8	4.5
				8/8/2018	KGS	937	62.9	24.3	13.4
				7/2/2019	KGS	992	94.8	23.6	11.3
				9/23/2020	KGS	984	91.2	25.4	9.5
5-1	02S-17E-31BADC	BR	43	8/15/2011	USGS	501	3.5	16.6	2.8
				9/23/2020	KGS	558	4.0	20.4	2.0
7-1	01S-16E-15DCDD	BR	69	8/16/2011	USGS	487	1.2	15.8	17.4
				8/8/2018	KGS	516	1.6	13.8	16.0
				7/2/2019	KGS	508	3.0	12.8	19.9
				9/23/2020	KGS	520	5.9	12.5	20.6
11-3	01S-17E-08CBB	BR	23.5	8/16/2011	USGS	715	29.0	76.6	2.5
				8/8/2018	KGS	1330	208	64.1	1.5
				7/2/2019	KGS	709	12.2	81.3	0.8
				9/23/2020	KGS	940	95.9	68.6	1.0

Monitoring Well Water Quality for Nemaha County

Site	Location	Co.	Depth well, ft	Date	Lab	SpC µS/cm	Cl mg/L	SO4 mg/L	NO3-N mg/L
0-3	04S-13E-15ABBB	NM	69	8/23/2011	USGS	677	12.4	12.6	4.3
				8/8/2018	KGS	605	11.4	13.2	4.3
				7/2/2019	KGS	696	10.1	10.6	5.3
				9/17/2020	KGS	701	11.3	13.4	5.1
18-2	03S-13E-13BAAB	NM	23	8/25/2011	USGS	885	1.8	43.7	45.8
				8/8/2018	KGS	824	8.9	38.2	33.1
				7/2/2019	KGS	896	6.5	69.0	30.8
				9/17/2020	KGS	896	13.9	66.1	28.2
18-3	01S-12E-01CDDA	NM	18.5	8/9/2011	USGS	831	8.8	94.3	1.5
				9/17/2020	KGS	963	12.2	124	2.8
19-1	03S-12E-11CDDD	NM	34	8/10/2011	USGS	755	2.4	30.3	9.6
				8/8/2018	KGS	782	3.3	26.8	10.8
				7/2/2019	KGS	831	4.8	27.9	11.4
				9/17/2020	KGS	857	9.7	29.2	13.3

Change in Chloride Concentration

August 2011 to September 2020

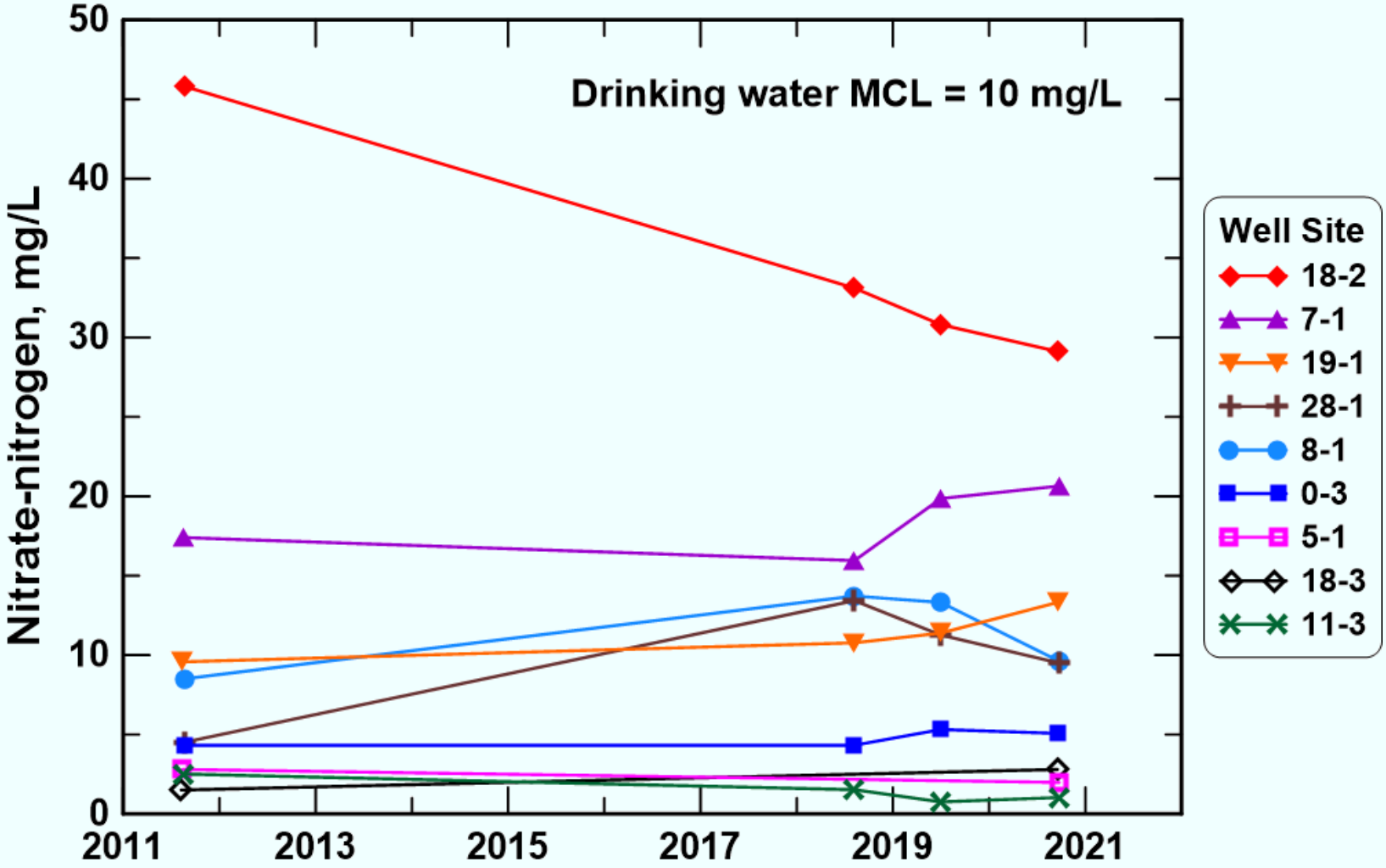


Dilution of saline bedrock water by precipitation and stream recharge.

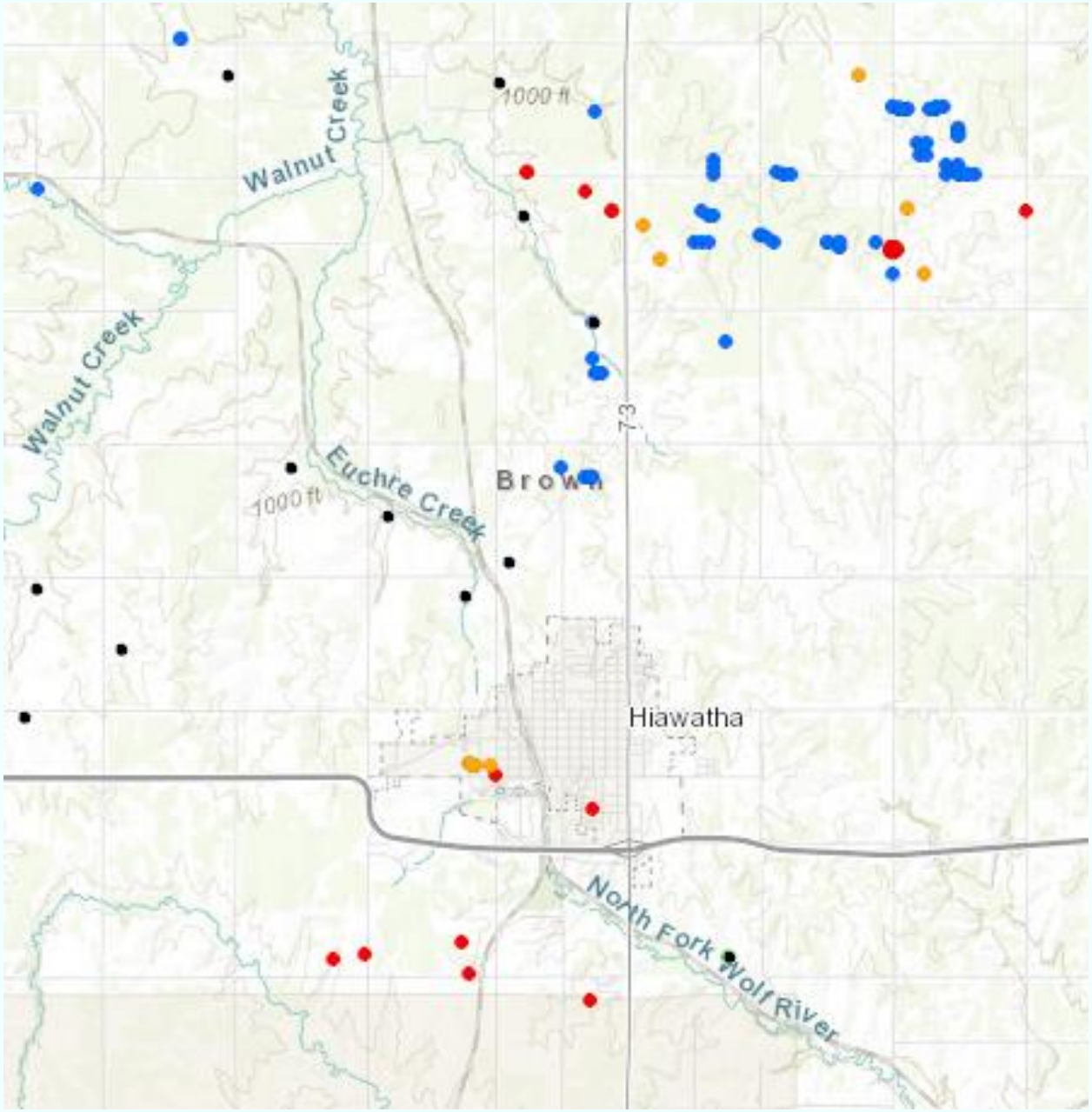
Infiltration of precipitation recharge that dissolved road salt.

Change in Nitrate Concentration

August 2011 to September 2020



Concentration at all except one site did not change substantially.
Both decreases and increases in concentration occurred.



Hiawatha Public Supply Wells

Two wells in city

Five wells south of city (one plugged)

Three wells north of city (currently being used)

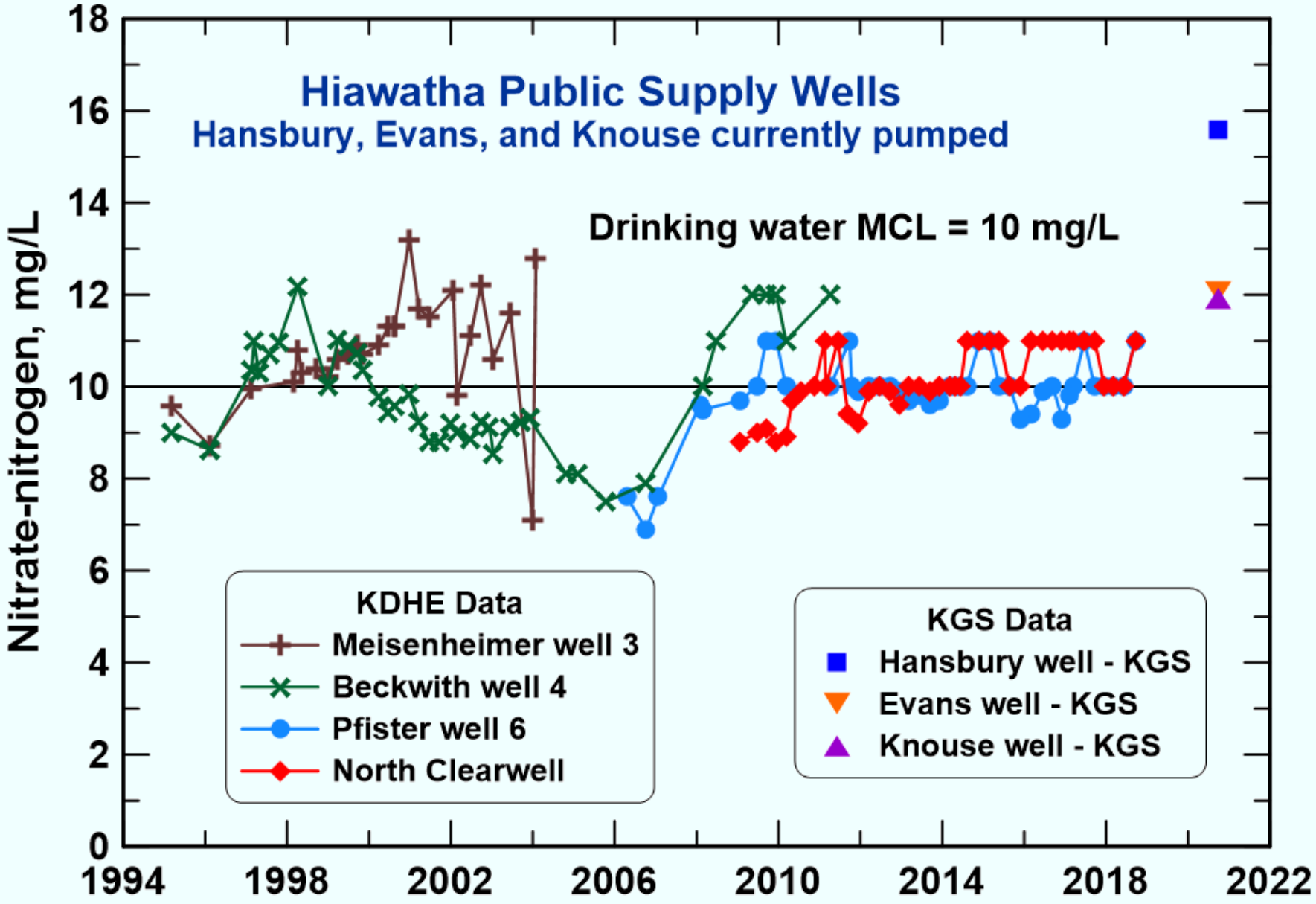
Water Rights

Red – public supply

Blue – irrigation

Orange – industrial

Black – surface water


Hiawatha Public Supply Wells
Hansbury, Evans, and Knouse currently pumped
Drinking water MCL = 10 mg/L
Nitrate-nitrogen, mg/L
18
16
14
12
10
8
6
4
2
0
1994
1998
2002
2006
2010
2014
2018
2022
KDHE Data
Meisenheimer well 3
Beckwith well 4
Pfister well 6
North Clearwell
KGS Data
Hansbury well - KGS
Evans well - KGS
Knouse well - KGS

Phase II Project Tasks

- Water Quantity
  1. Assess robustness of existing (Phase I) data interpretation
  2. Improve location accuracy for some wells
  3. *Identify* and equip existing wells for continuous water level monitoring
  4. Install new monitoring wells in critical locations
  5. *Interpret groundwater level surface* and estimate aquifer storage and safe yield
- Water Quality
  1. Interpret existing water-quality data and trends
  2. *Select groundwater quality monitoring locations and collect samples*
  3. *Analyze samples*
  4. *Interpret new data* and plan for future sampling
- Information Dissemination
  1. Make information publicly available through project website

Focus for Next Few Months

- Install telemetry equipment at MO RAC 5-1 and 28-1 for real-time transmission of water level data to KGS; telemetry equipment includes barometric pressure sensors
- Work on locating additional monitoring wells (existing and new), especially further south
- Update website to serve continuous data
- Start interpreting continuous data

Schedule

We are here??

Task	Year 1	Year 2	Year 3	Year 4	Year 5
Water Quantity 1	✓				
Water Quantity 2	✓				
Water Quantity 3		✓			
Water Quantity 4					
Water Quantity 5	✓	✓			
Water Quality 1	✓				
Water Quality 2	✓	✓			
Water Quality 3	✓	✓			
Water Quality 4		✓			
Info. Dissemination	✓	✓			

Project web site:

http://www.kgs.ku.edu/Hydro/Missouri/index.html