The Springs of Denham Springs History, Water Quality and Source

Douglas Carlson
Louisiana Geological Survey

13 th Annual Louisiana Water Conference

April 15, 2019

1) Introduction
2) A Brief History
3) Water Quality of Seeps/Springs
   a) compared to city water
   b) compared to portions of Southern Hills Aquifer System
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4) Possible Water Sources
   a) groundwater – Southern Hills Aquifer system
   b) groundwater – brackish-saline-brines below Southern Hills Aquifer system
   c) surface water
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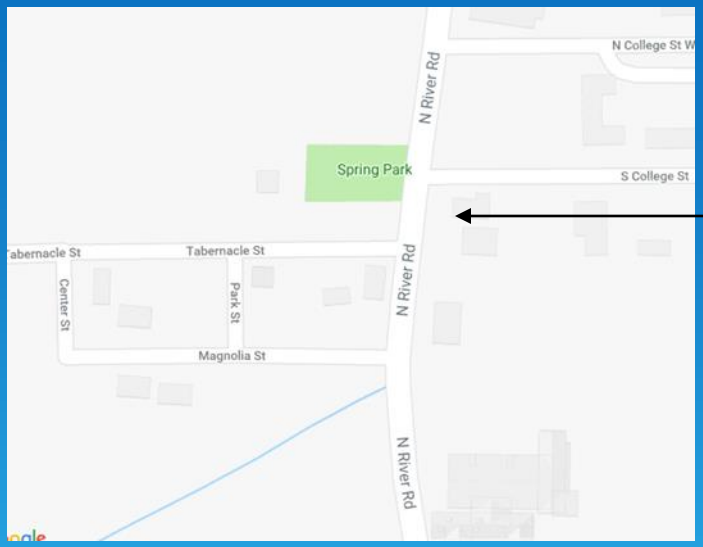
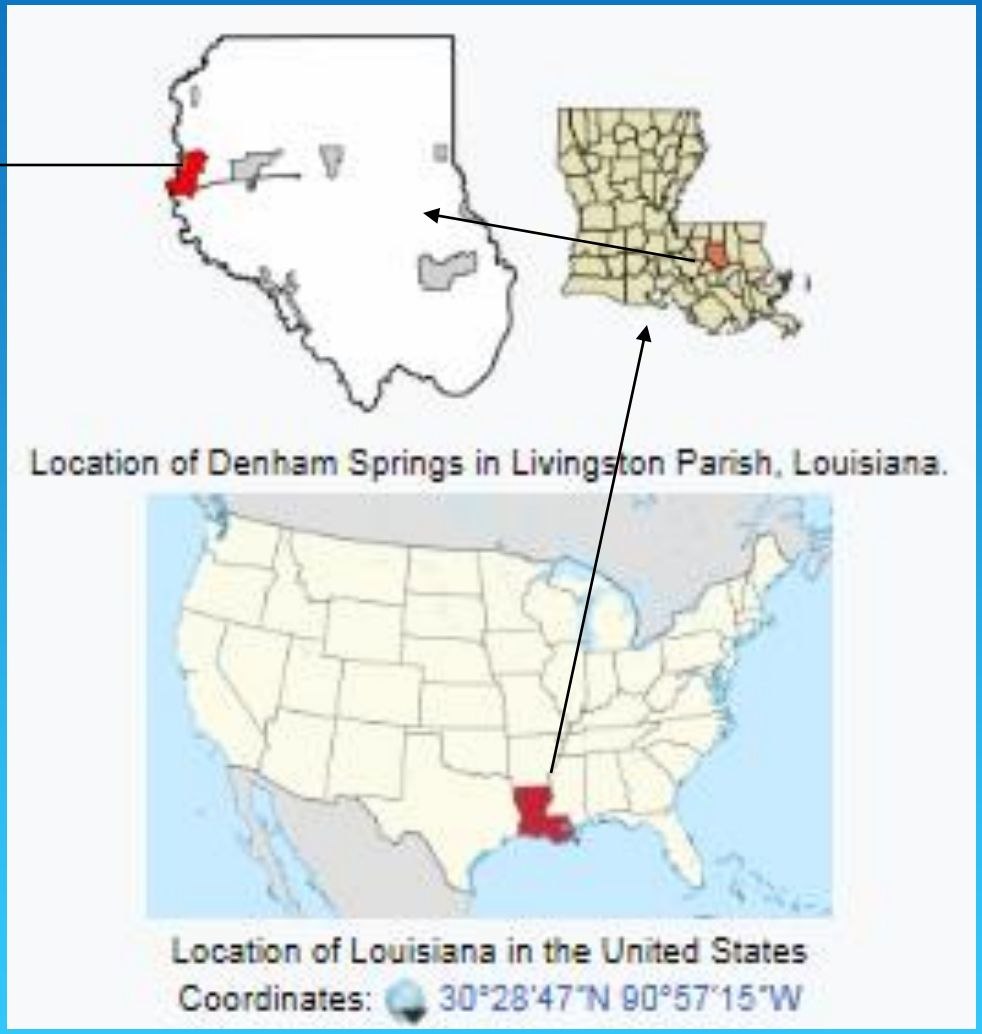
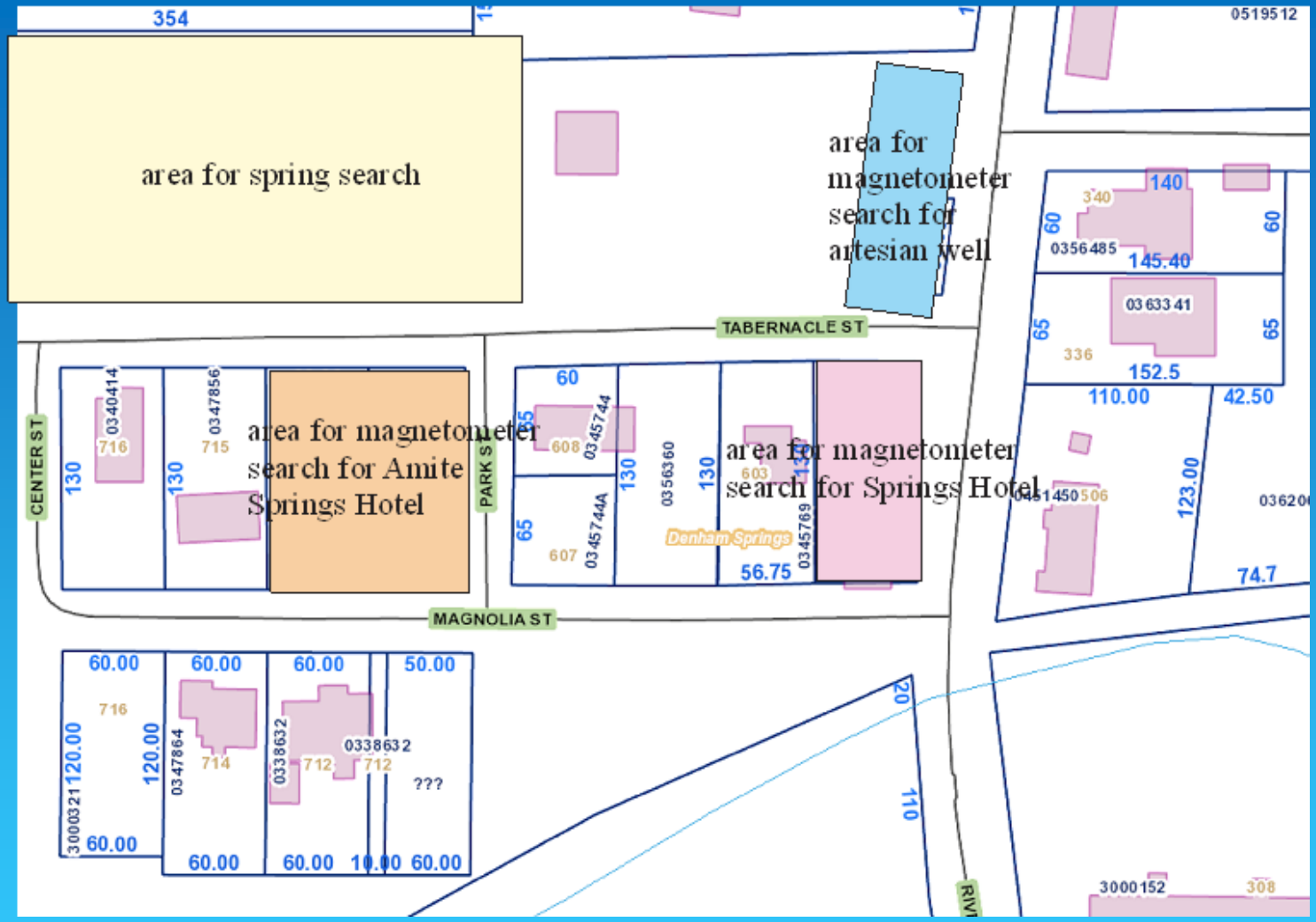
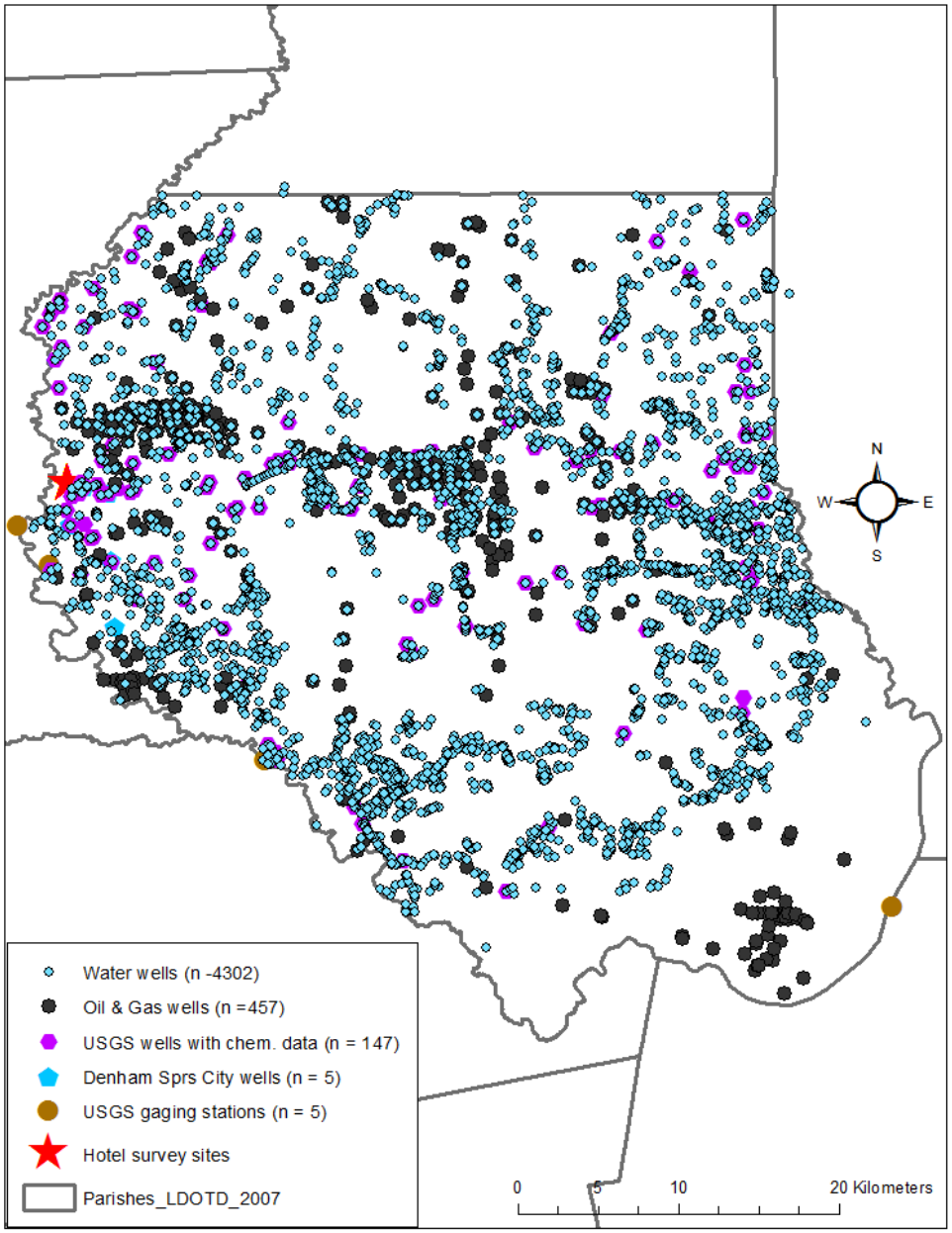
1) Introduction


N College St W
N River Rd
Spring Park
S College St
Tabernacle St
Tabernacle St
Center St
Park St
N River Rd
Magnolia St
N River Rd

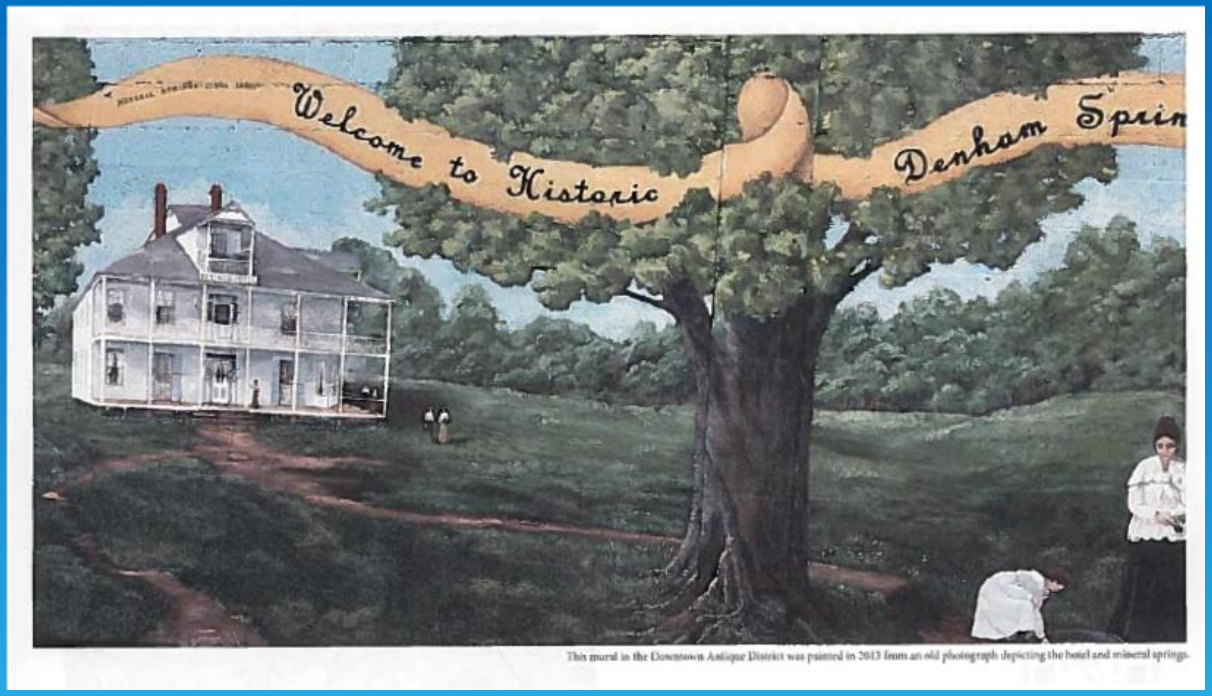

Location of Denham Springs in Livingston Parish, Louisiana.
Location of Louisiana in the United States
Coordinates: 30°28'47"N 90°57'15"W



Map of a proposed study areas in and near Spring Park, Denham Springs, Louisiana (base map from Livingston Parish Assessor, 2018)


N
W
E
S
Water wells (n -4302)
Oil & Gas wells (n =457)
USGS wells with chem. data (n = 147)
Denham Sprs City wells (n = 5)
USGS gaging stations (n = 5)
Hotel survey sites
Parishes_LDOTD_2007
0
5
10
20 Kilometers

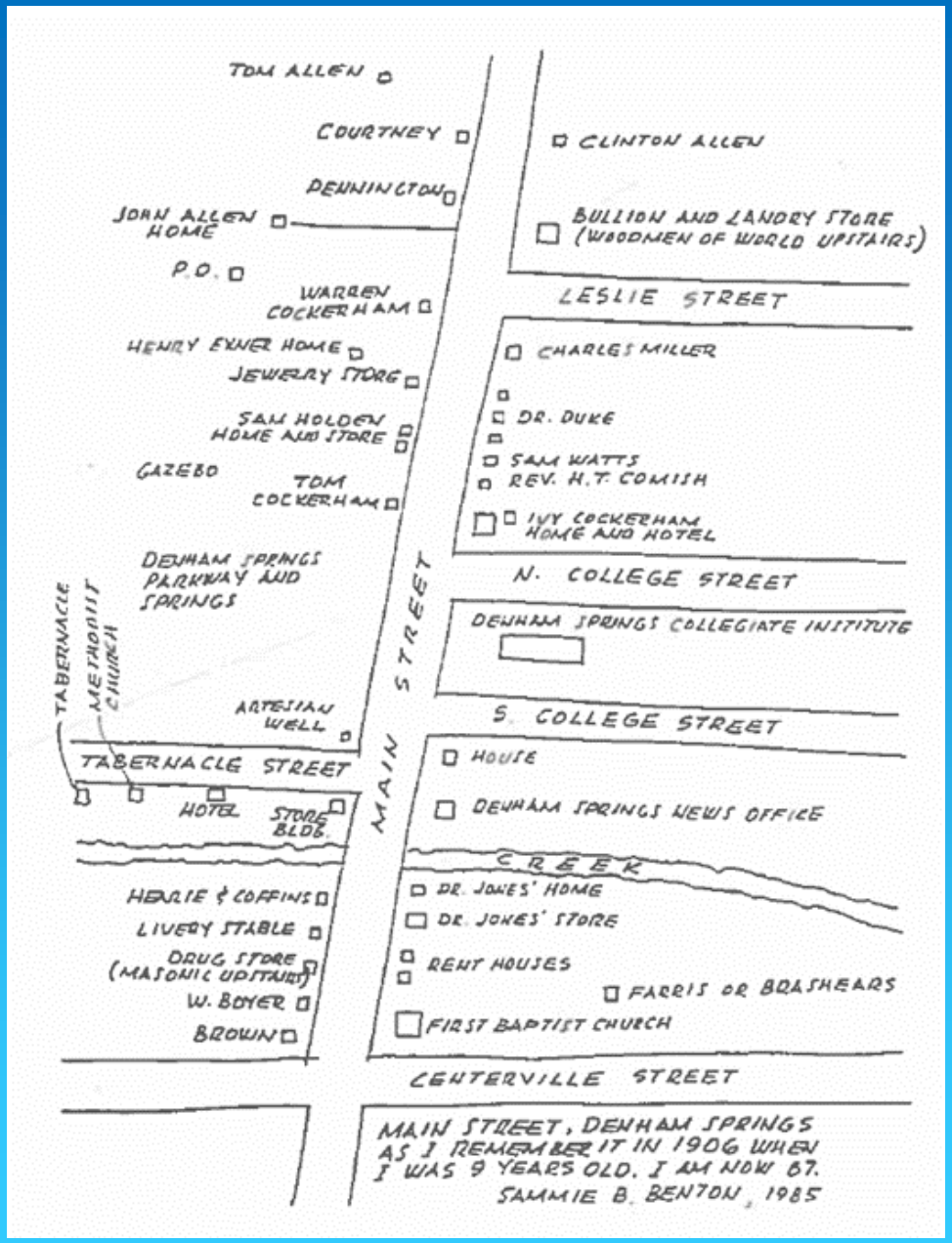
2) A Brief History



This mural in the Downtown Antique District was painted in 2013 from an old photograph depicting the hotel and mineral springs.

Drawing of Amite Springs Hotel, source drawing on page 6 of City of Denham Springs (2017)

Picture of first hotel, tribute in 2004 (Oubre, 2013)



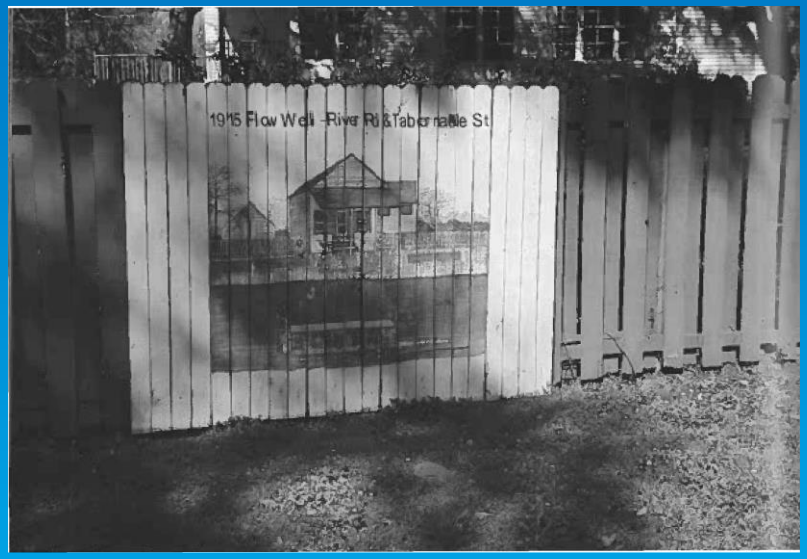
Old map showing location of 1850s hotel on Tabernacles Street, source map on page 64 of History Book Committee (1986)

Watson Hotel, 1899, built on land which Denham Springs Hotel occupied before in 1860s fire raised the hotel (Oubre, 2013)

Picture of Spring Hotel on River Road (Main Street) that opened in 1906 (Livingston Parish American Revolution Bicentennial Committee, 1976; and Oubre, 2013).

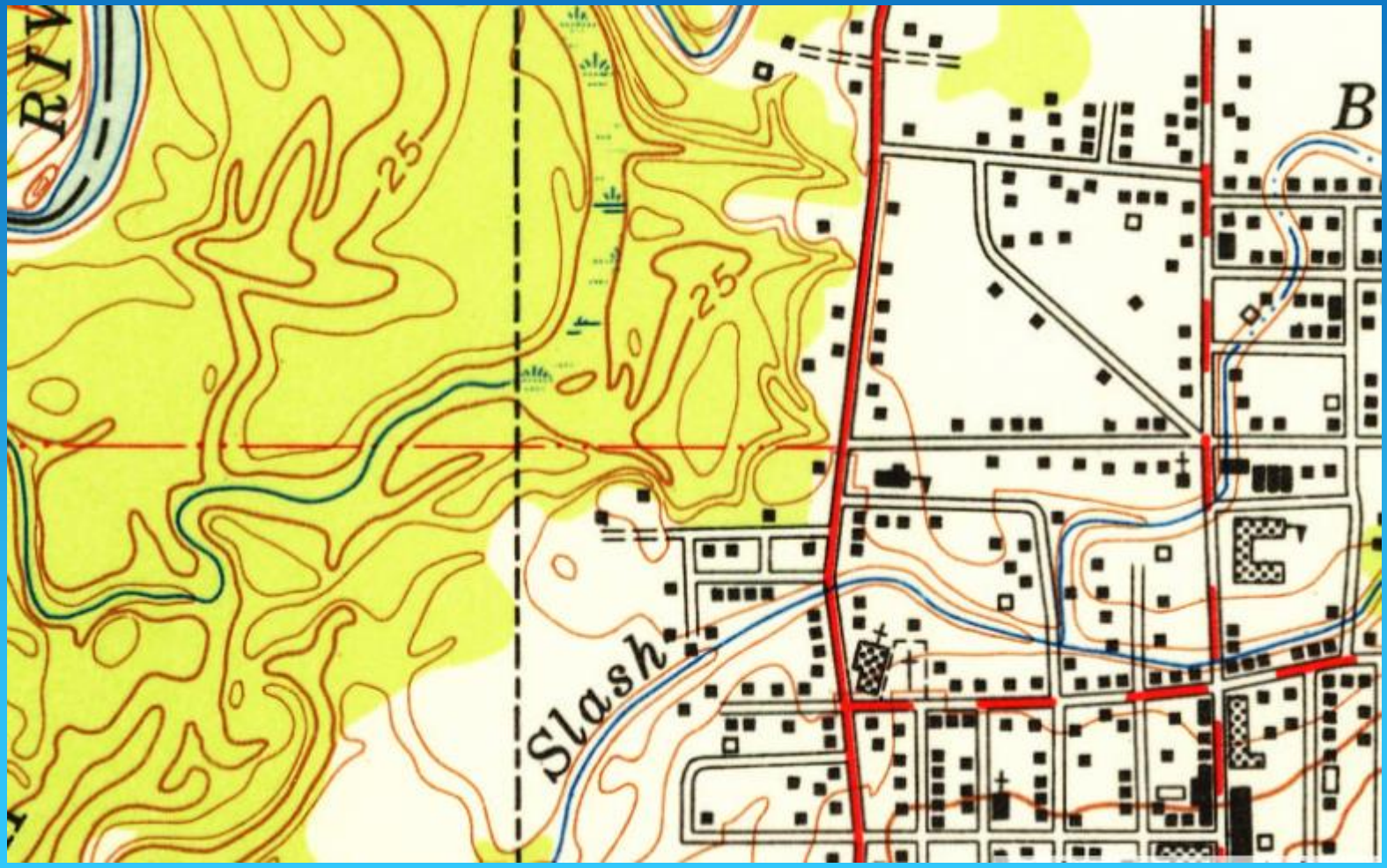
(Oubre, 2013)

Women drinking from Denham Springs in early 20th century



Left picture of artesian well, source photo on page 67 of History Book Committee (1986). Right picture artesian well (flow well) 1915, tribute in 2004 (Oubre, 2013)

1934 USGS topo map of west side of Denham Springs around Spring Park

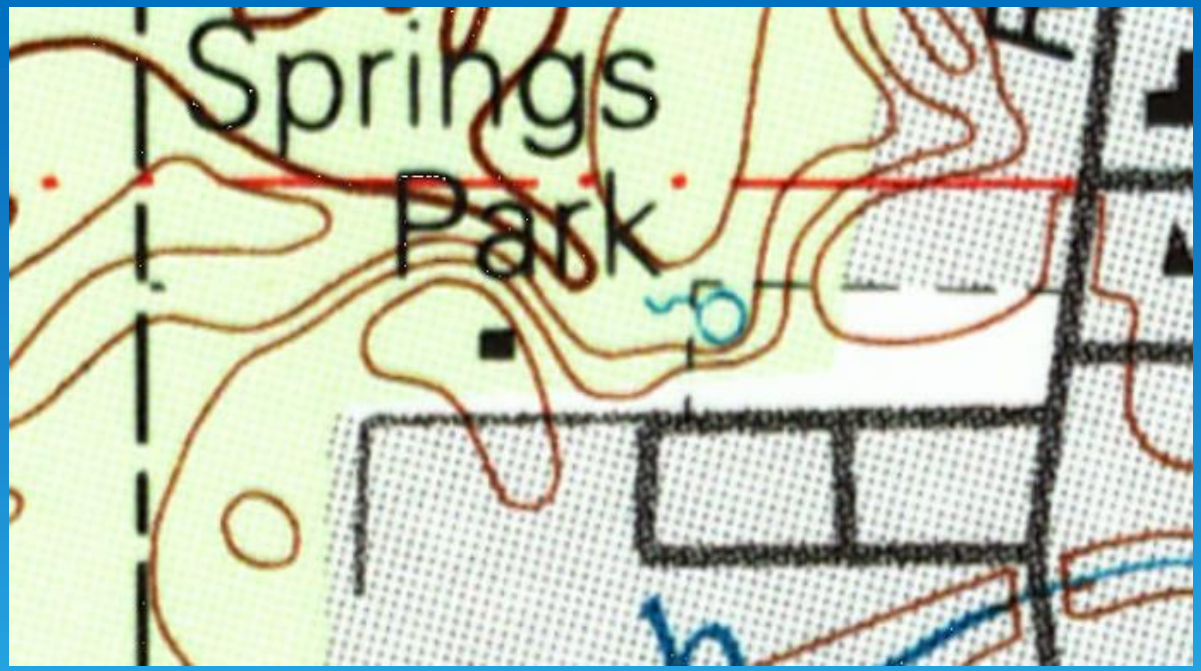


1953 USGS topo map of west side of Denham Springs around Spring Park

1963 & 1980 USGS topo maps of west side of Denham Springs around Spring Park

Old cement cistern around one of the springs (Livingston Parish American Revolution Bicentennial Committee, 1976.

Picture in spring of 2018 of spring with cement cistern around it

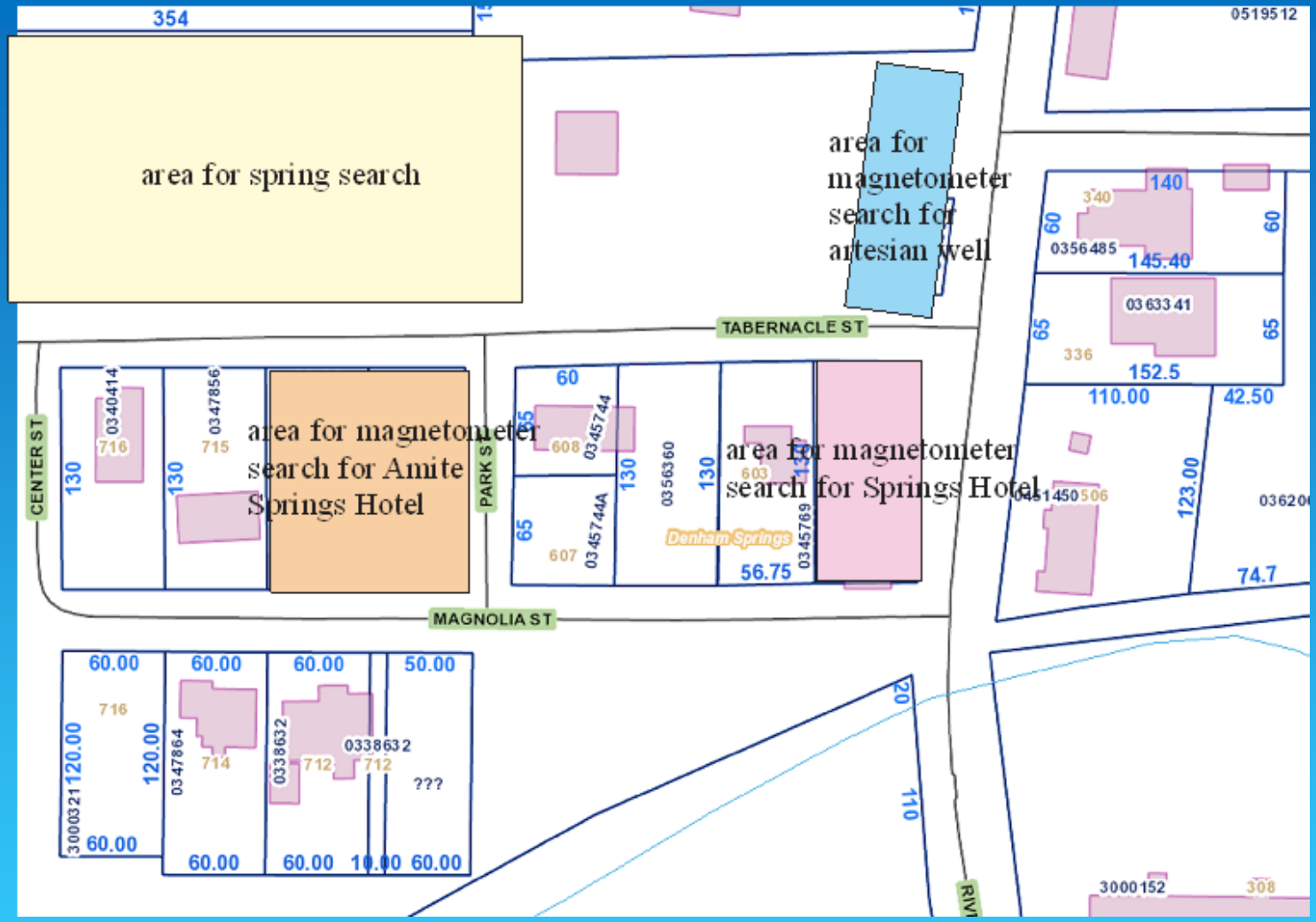


1991 & 1995 USGS topo maps of west side of Denham Springs around Spring Park

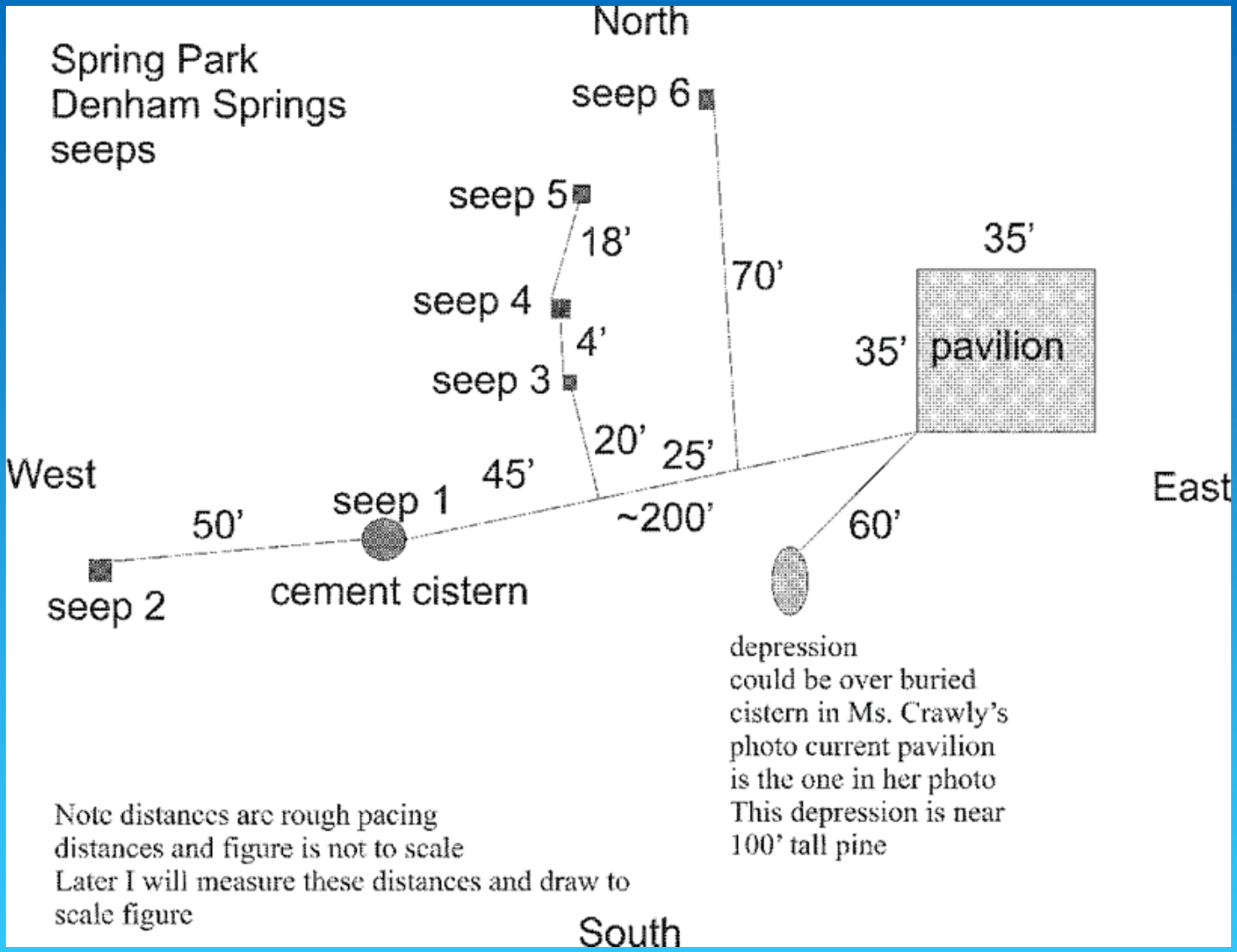
Google earth image around Spring Park, October 2016

3) Water Quality of Seeps/Springs
a) compared to city water

Right picture is of a natural spring within Spring Park. It is the one with following water as observed on April 21 and 28, 2018. The red stick is a foot long ruler. One of five natural springs/seeps found in April of 2018



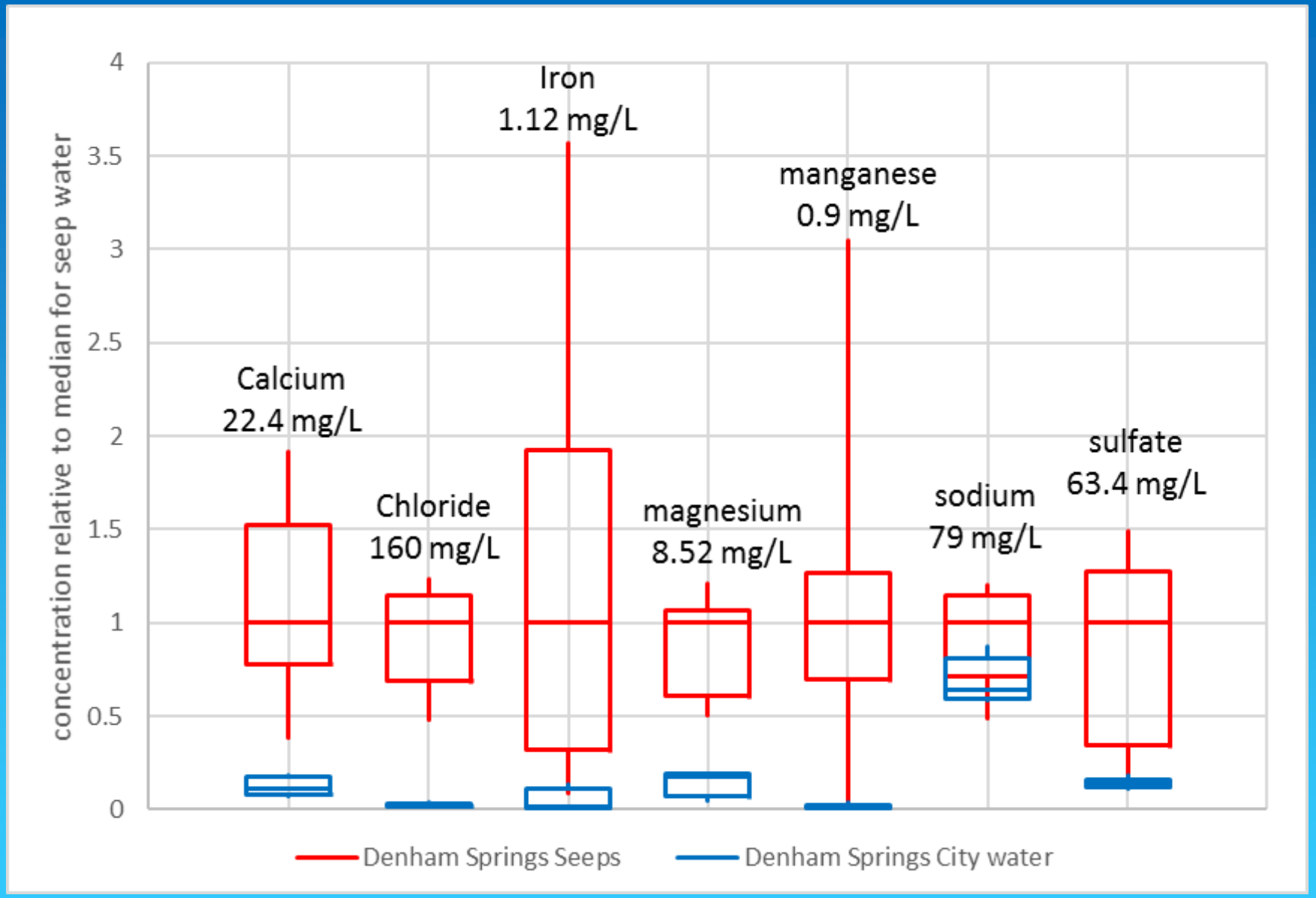
Map of a proposed study areas in and near Spring Park, Denham Springs, Louisiana (base map from Livingston Parish Assessor, 2018).



relative positions of six seeps/springs observed in Spring Park, Denham Springs in April, 2018

3) Water Quality of Seeps/Springs

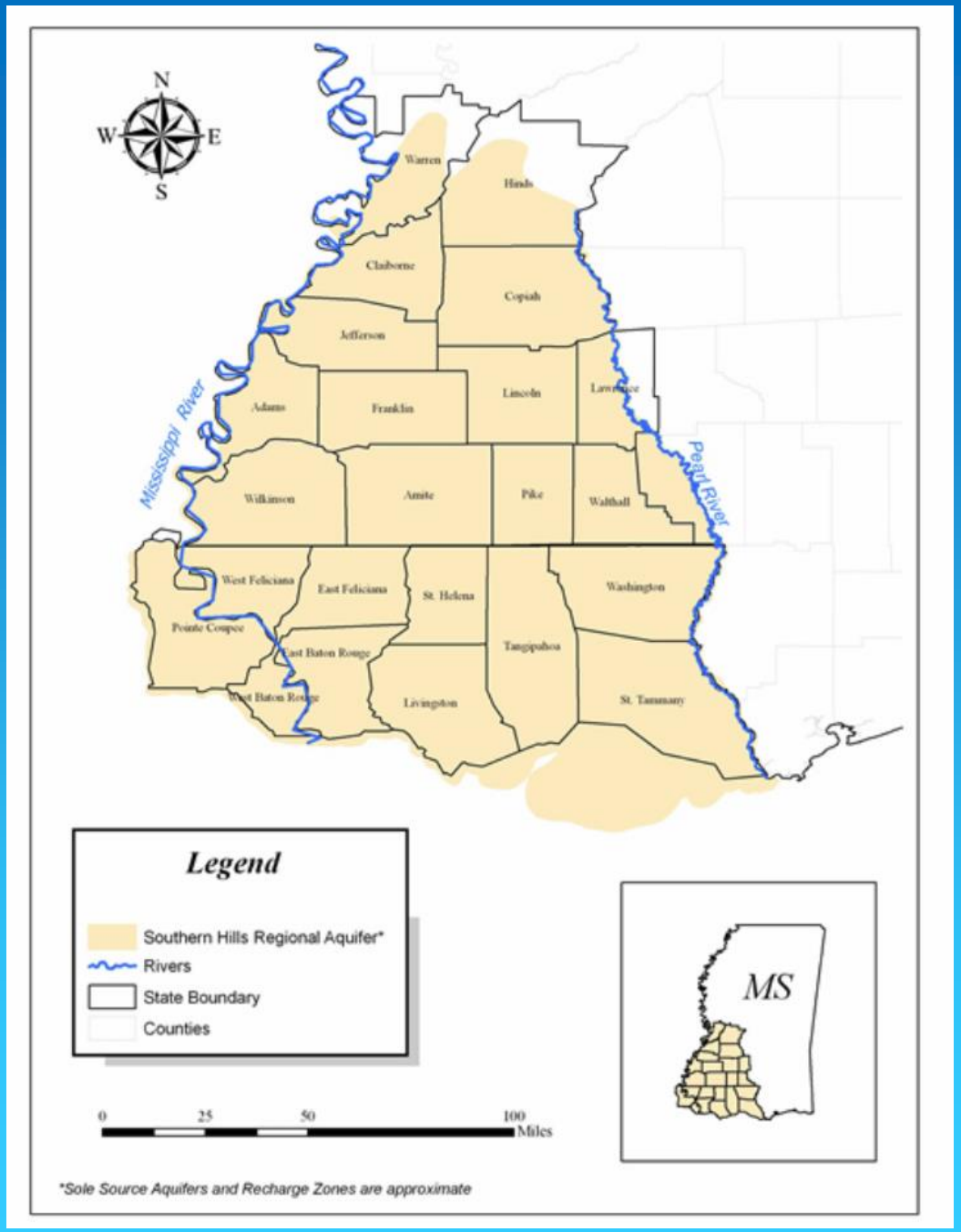
a) Denham Springs city water



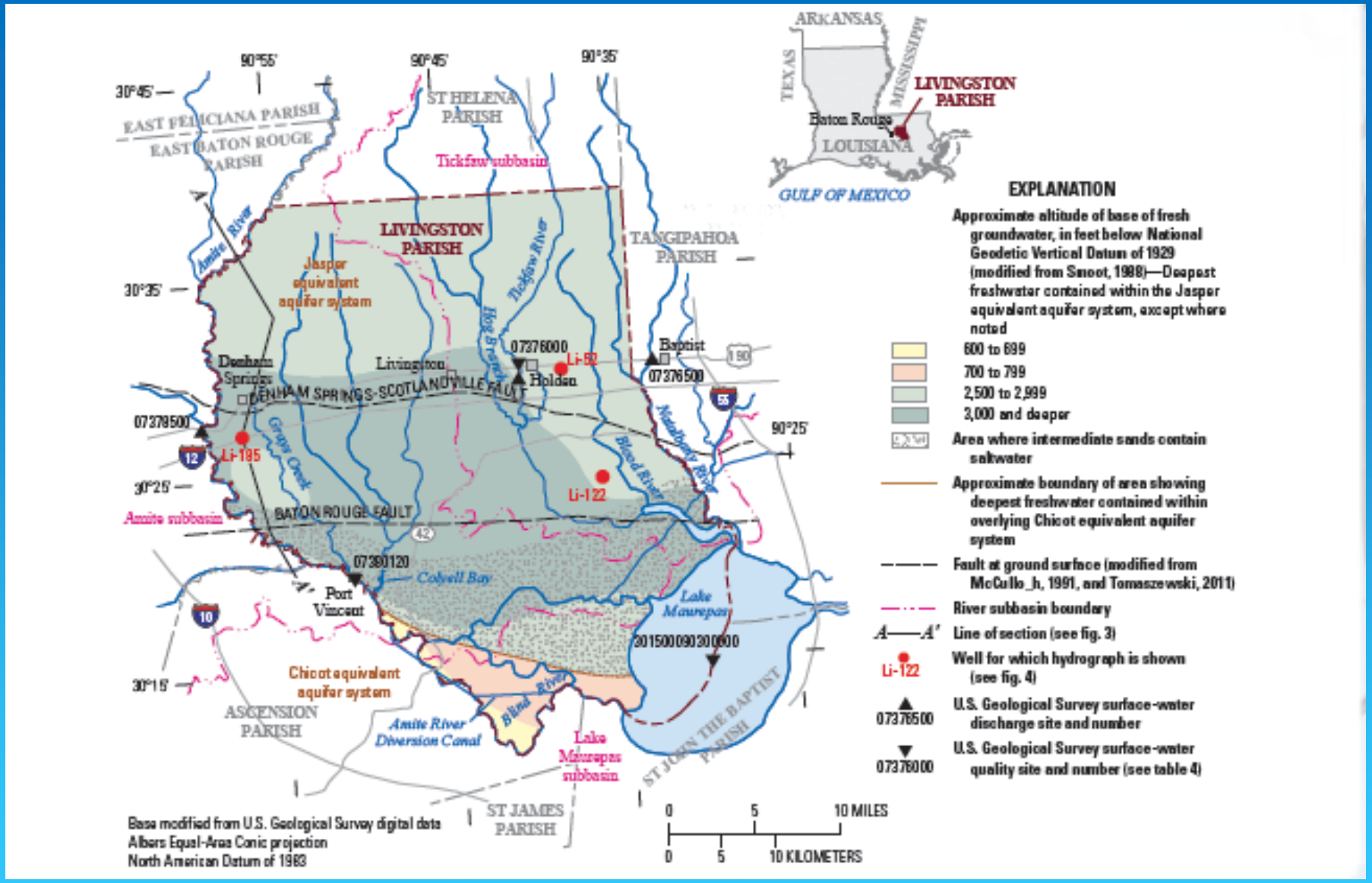
Median values of ion concentration in seep water is below each ion name

3) Water Quality of Seeps/Springs

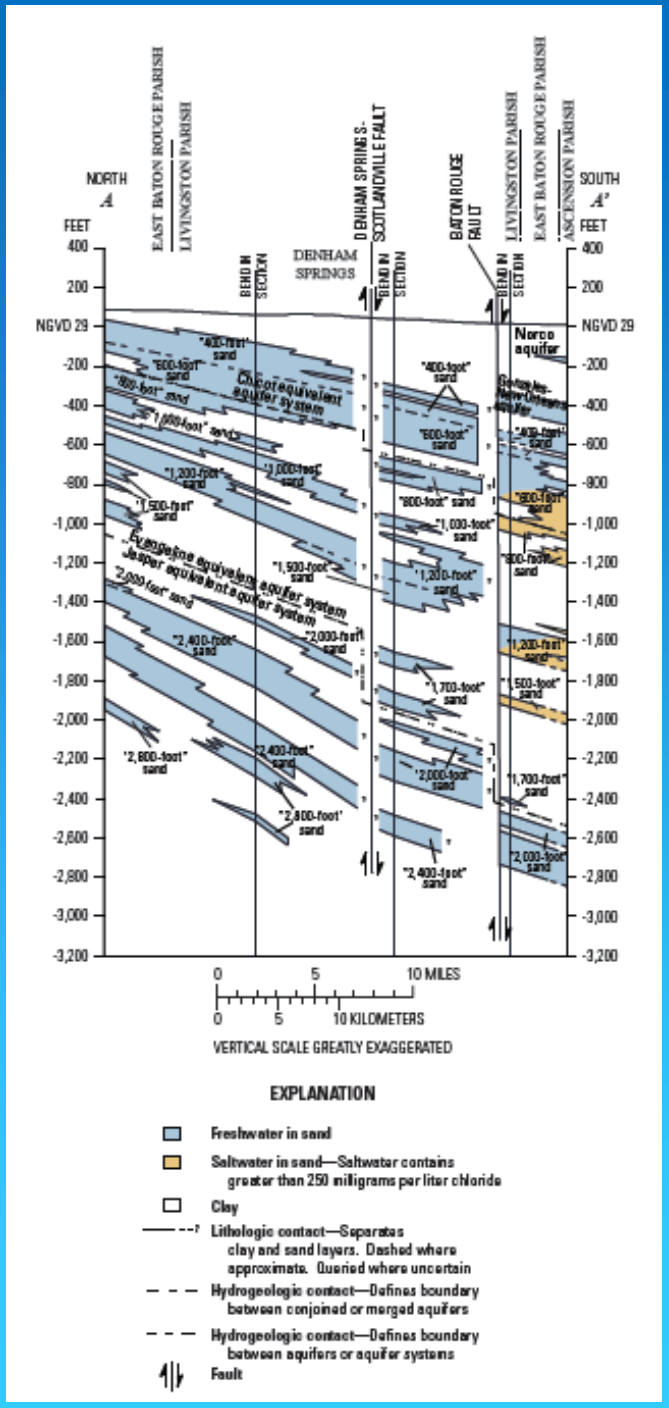
b) compared to portions of Southern Hills Aquifer System



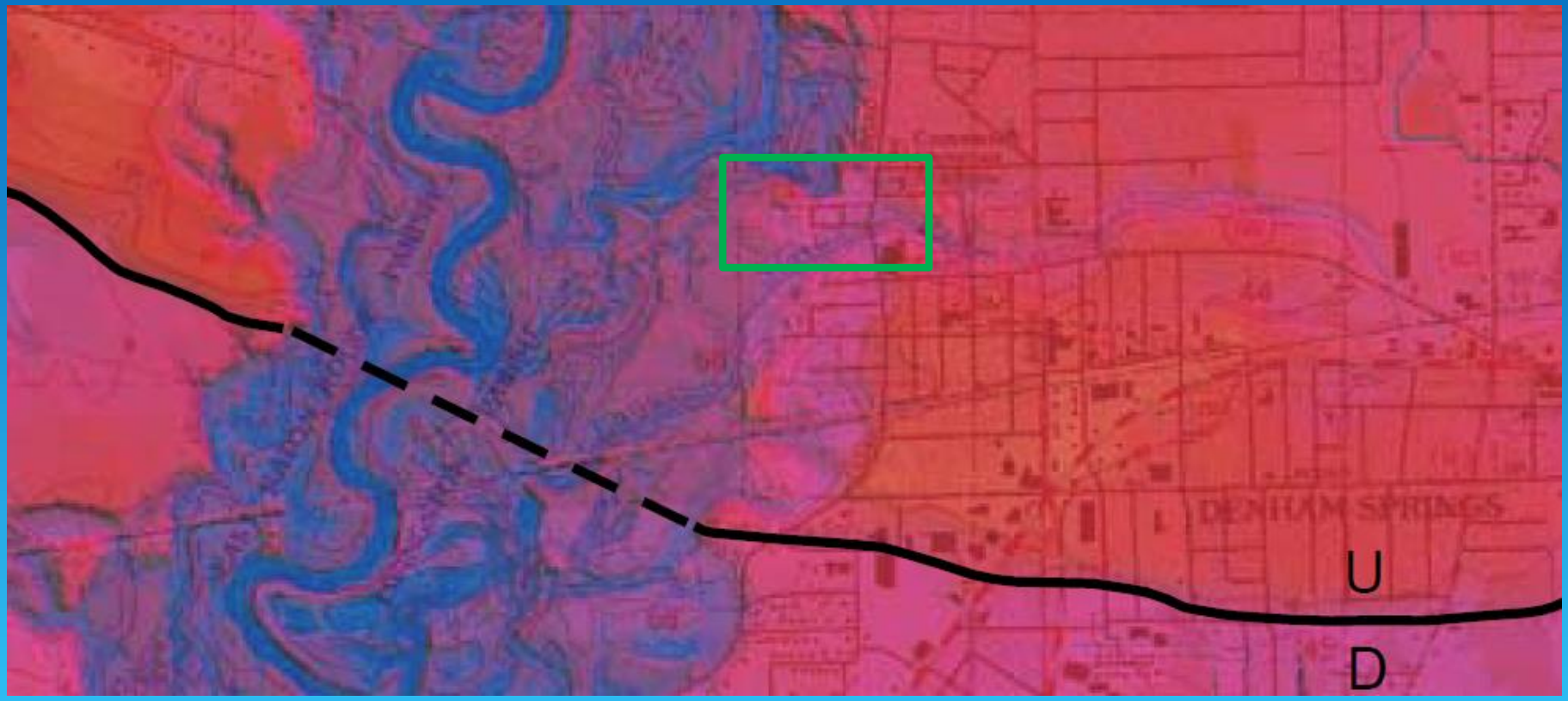
Tan is the extent of Southern Hills Aquifer System, which is a sole source aquifer generally SE Louisiana (Stuart et al., 1994; and US. EPA, 2011).



Base of fresh groundwater in Livingston Parish (White and Prakken, 2016)

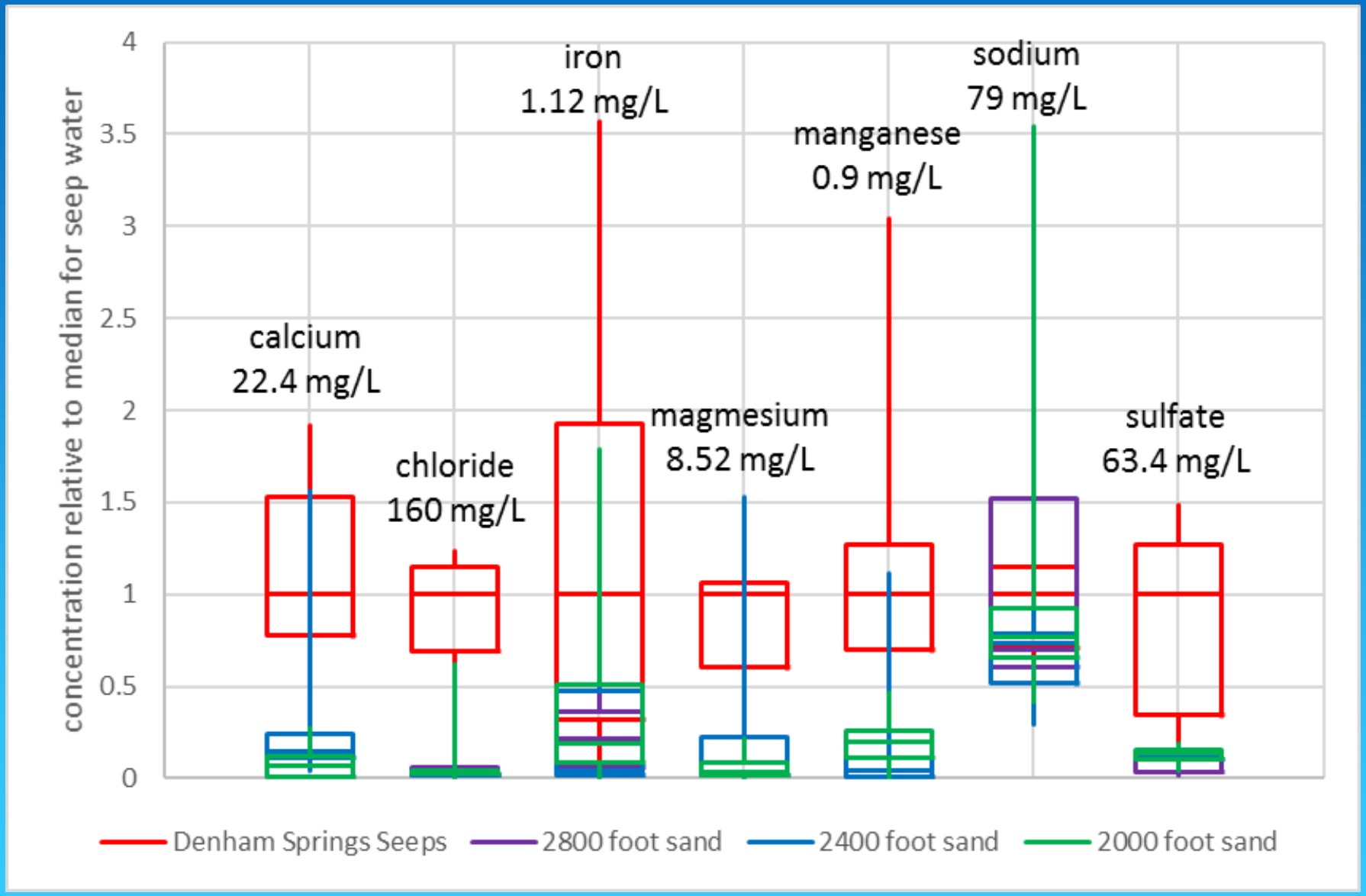


Generalized cross-section
of aquifers in Livingston Parish
From north to south (White and Prakken, 2016)



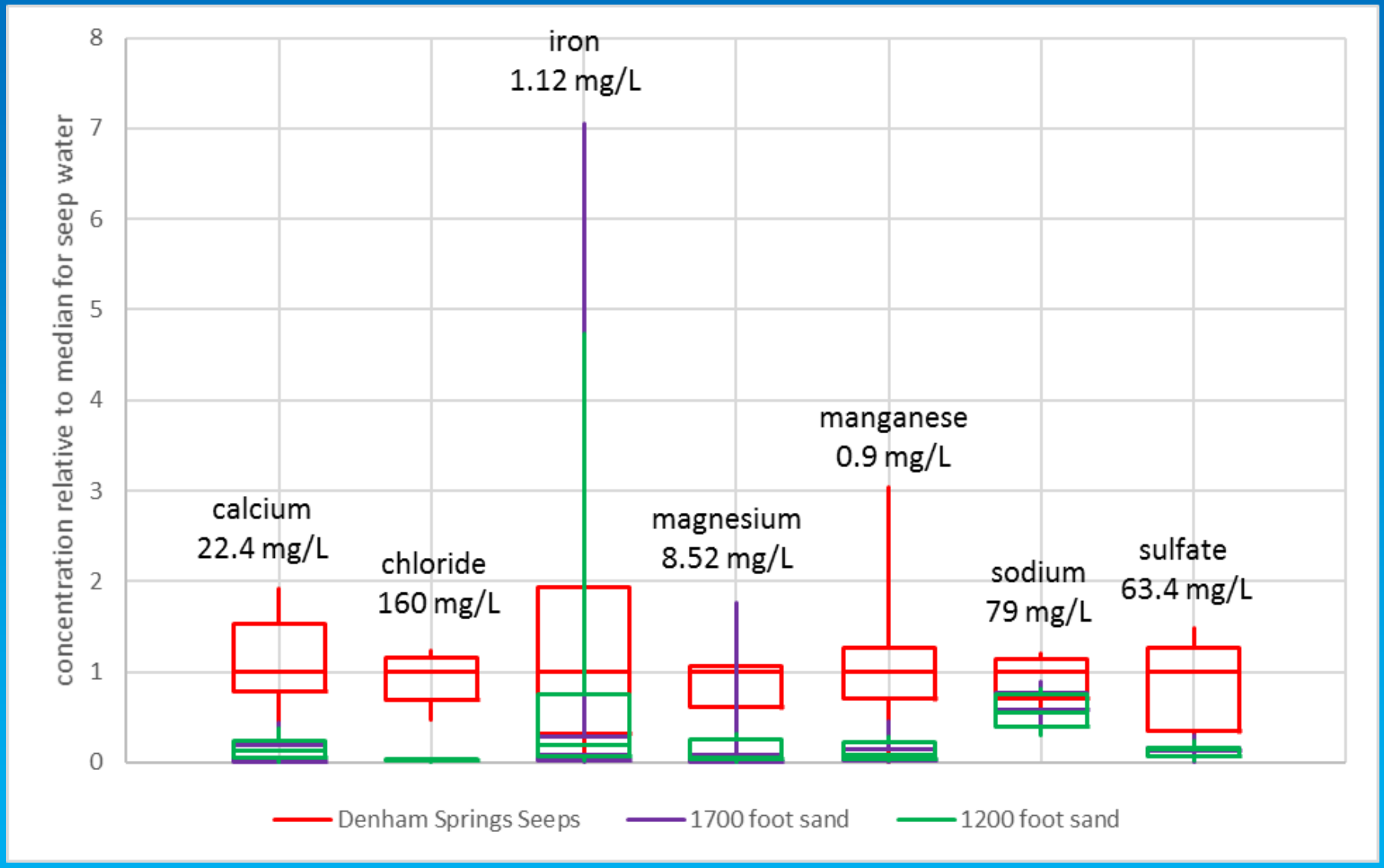
Location of Scottlandville-Denham Springs Fault McCulloh, 2003)

Sands in the Jasper Equivalent portion of Southern Hills Aquifer System



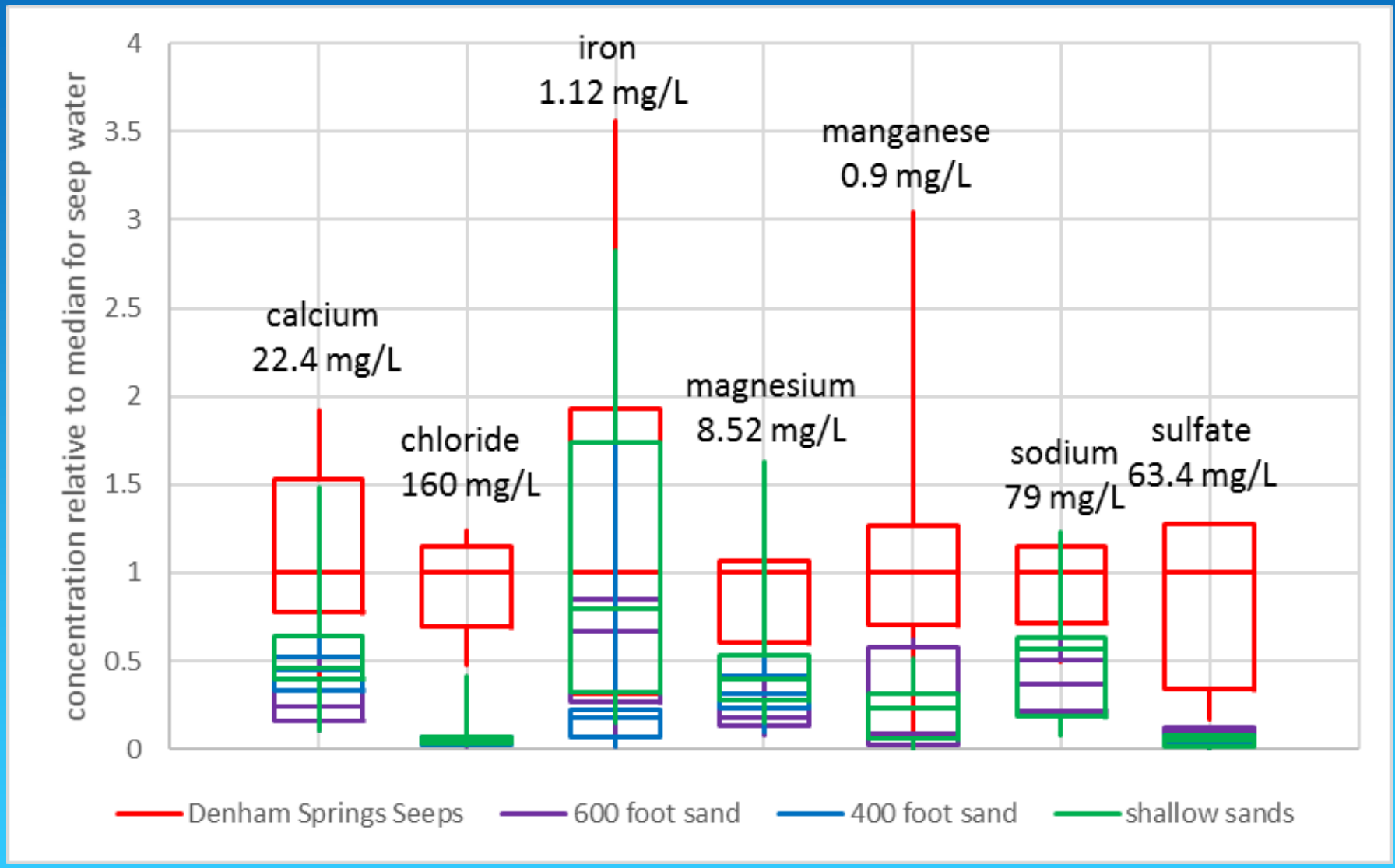
Median values of ion concentration in seep water is below each ion name

Sands in the Evangeline Equivalent portion of Southern Hills Aquifer System



Median values of ion concentration in seep water is below each ion name

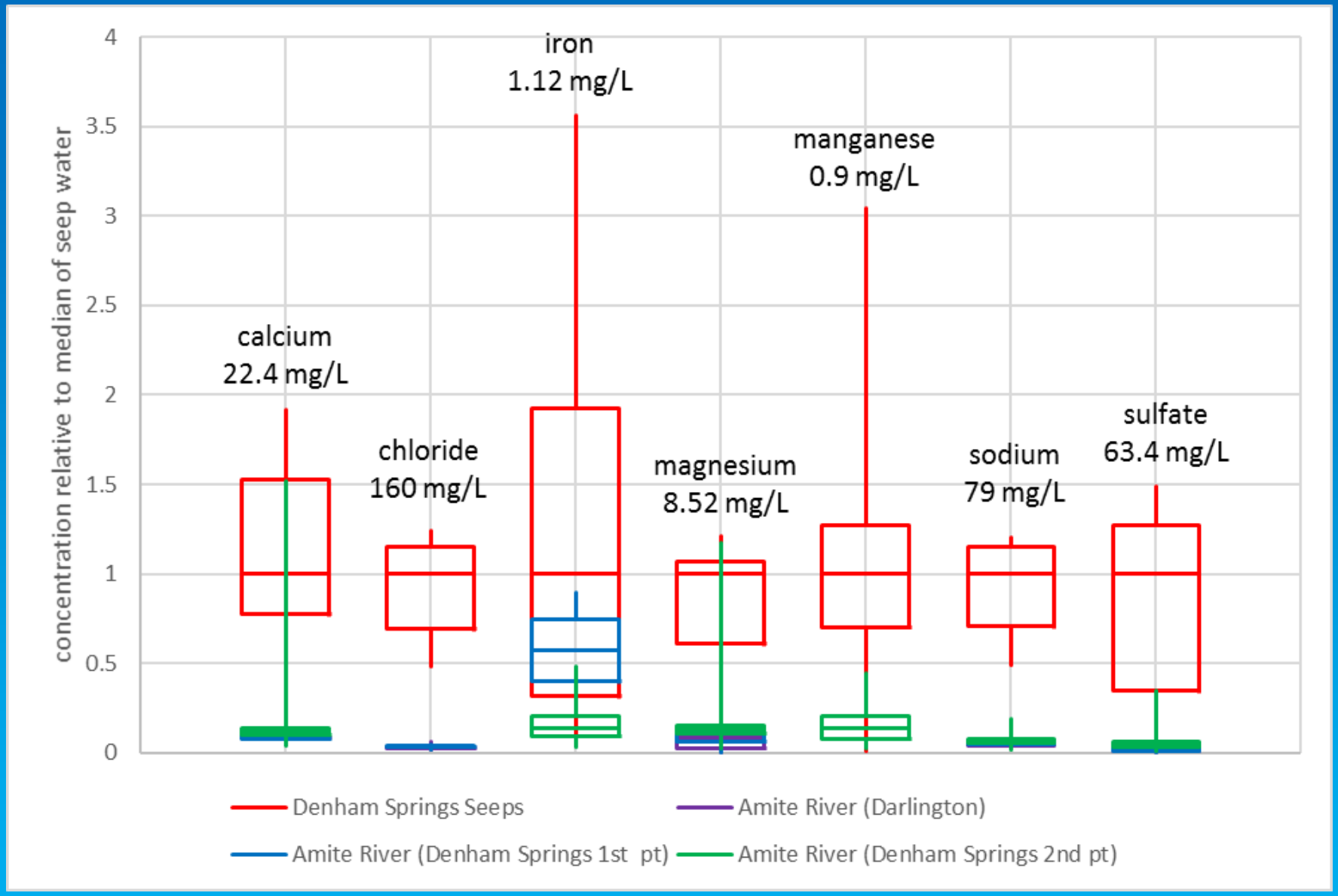
Sands in the Chicot Equivalent portion of Southern Hills Aquifer System



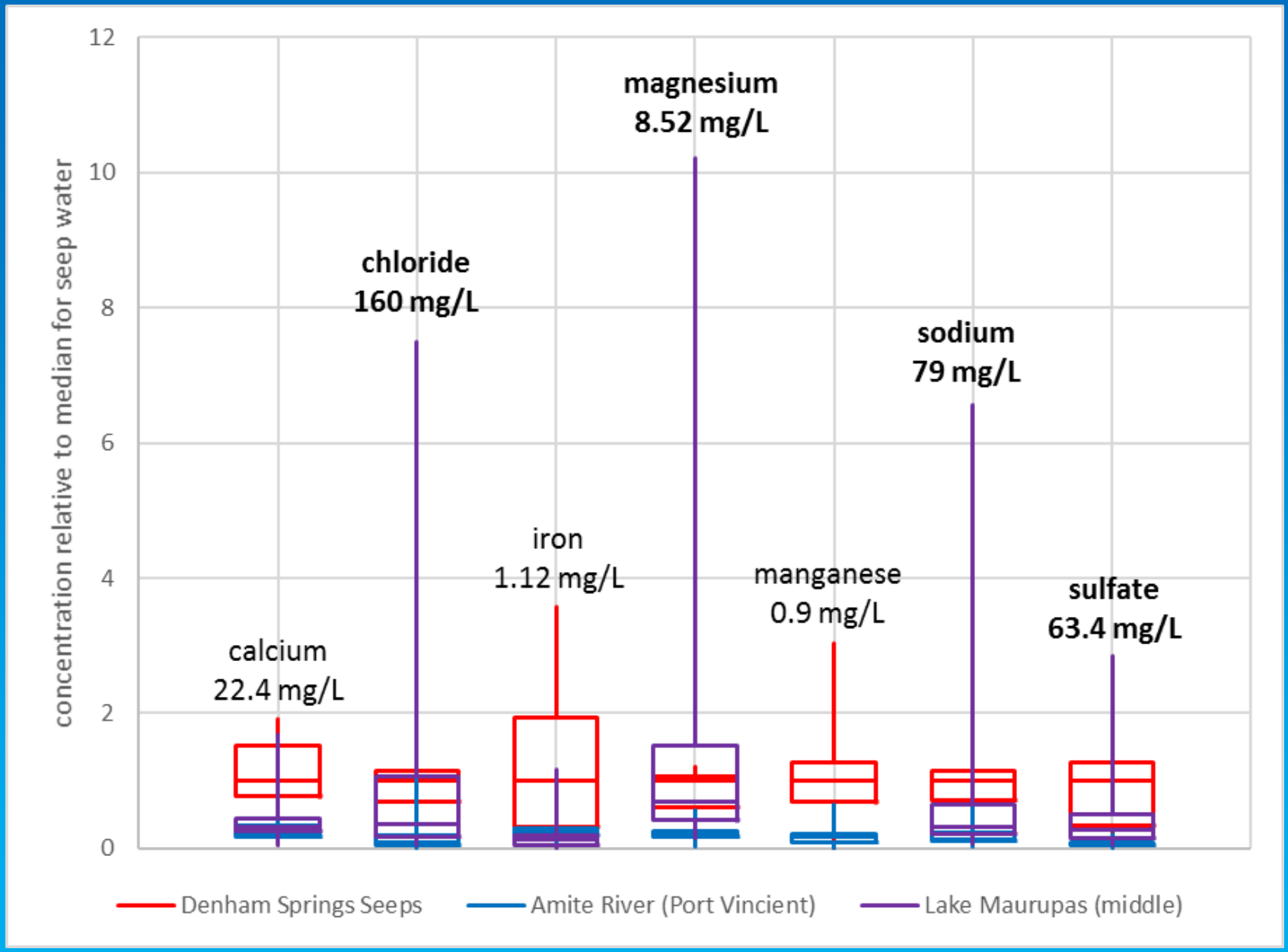
Median values of ion concentration in seep water is below each ion name

3) Water Quality of Seeps/Springs
c) compared to Surface waters

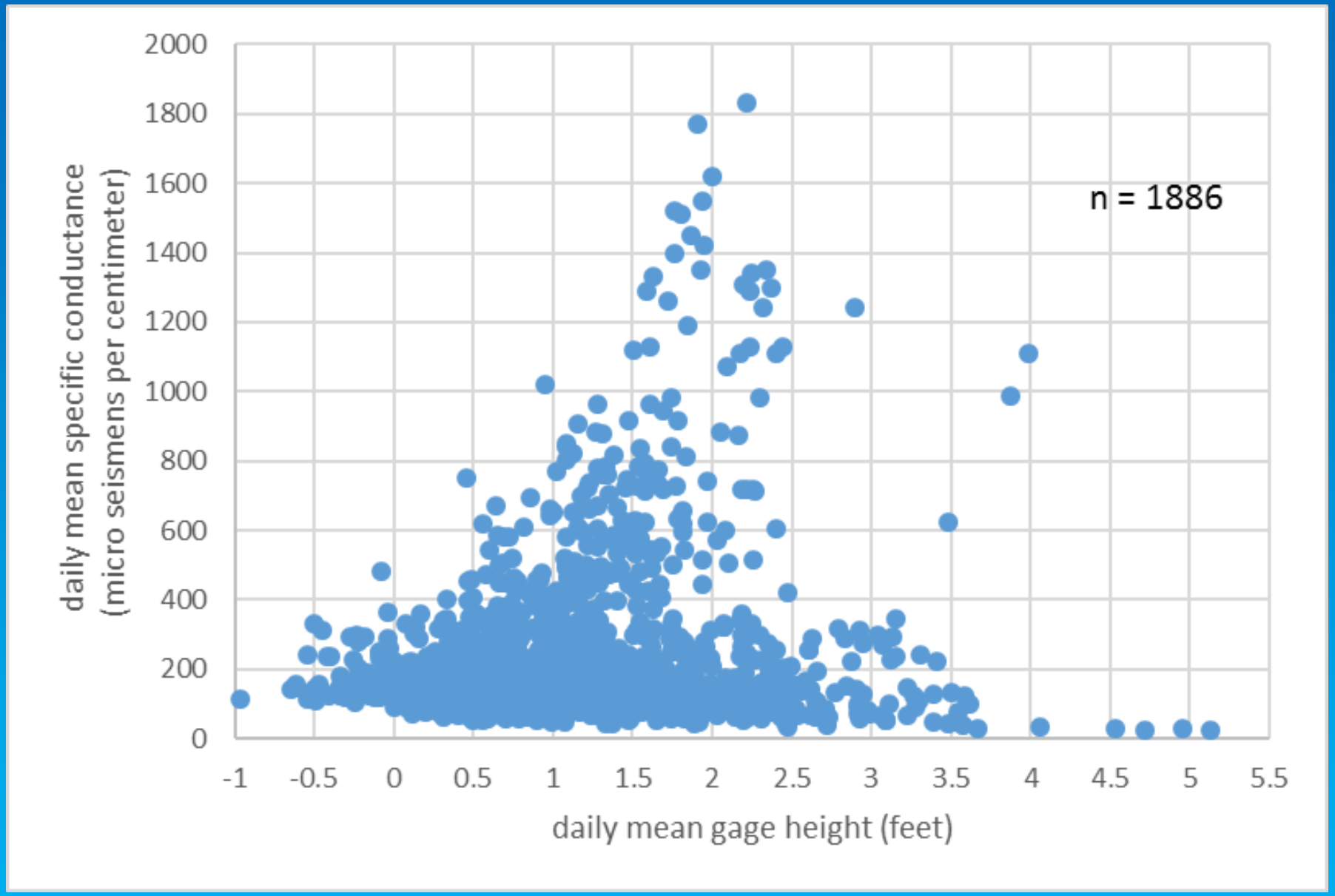
Spring during an Amite River flood (Oubre, 2013)



Median values of ion concentration in seep water is below each ion name



Median values of ion concentration in seep water is below each ion name


daily mean specific conductance (micro seismens per centimeter)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
n = 1886
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
daily mean gage height (feet)

4) Possible Water Sources

a) groundwater – Southern Hills Aquifer system

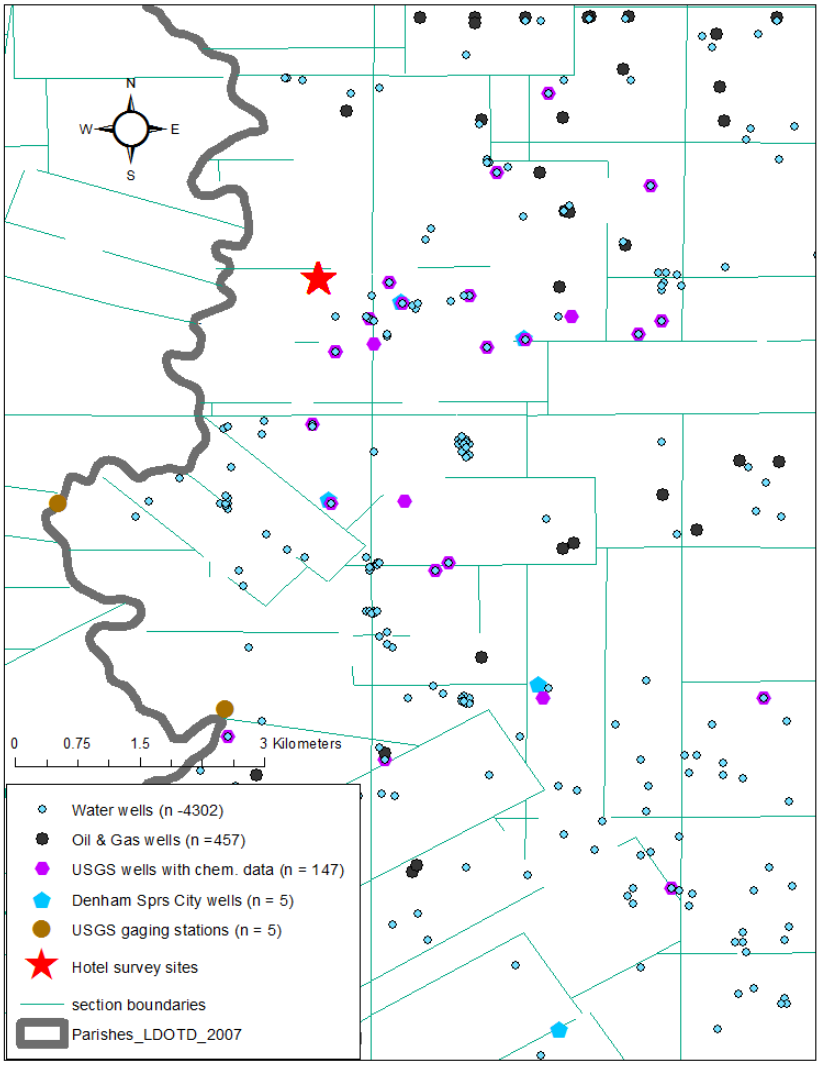
The shallow aquifer could be a source for some of the metals ions, such as iron and manganese, but only a portion. Even for these ions shallow aquifers have ion concentrations typically too low. This is even more the truth for lower aquifers. These aquifers have concentrations of chloride far too low to account for concentrations in seep water.

4) Possible Water Sources

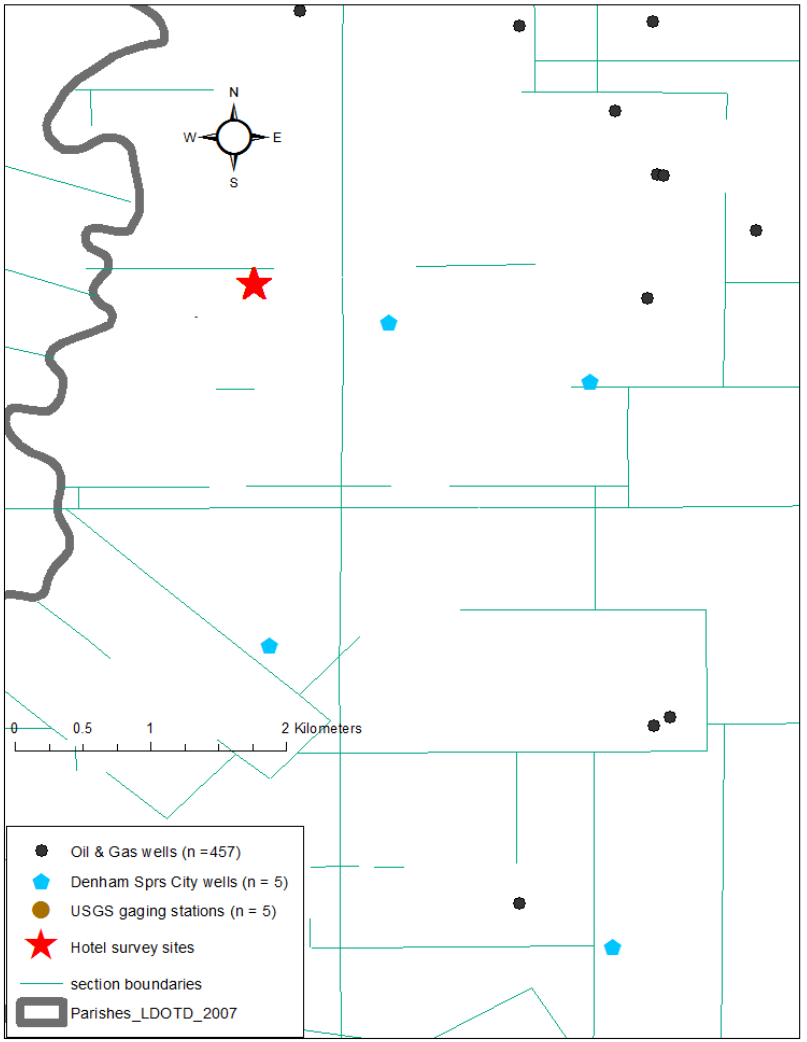
b) groundwater – brackish-saline-brines below Southern Hills Aquifer system

There are three reason this is not a likely
Source for seep water.

1) Oil and gas development did not start until 1937 (History Book Committee, 1986)
2) If leaks occurred along nearby Scottville-Denham Springs fault why did water only impact near surface seep water without impacting nearby city wells near the fault?
3) Even for today distance to nearest oil and gas well is over 2 kilometer from seeps. I would take far to long, decades, for water to travel to seep at present potentiometric gradients.



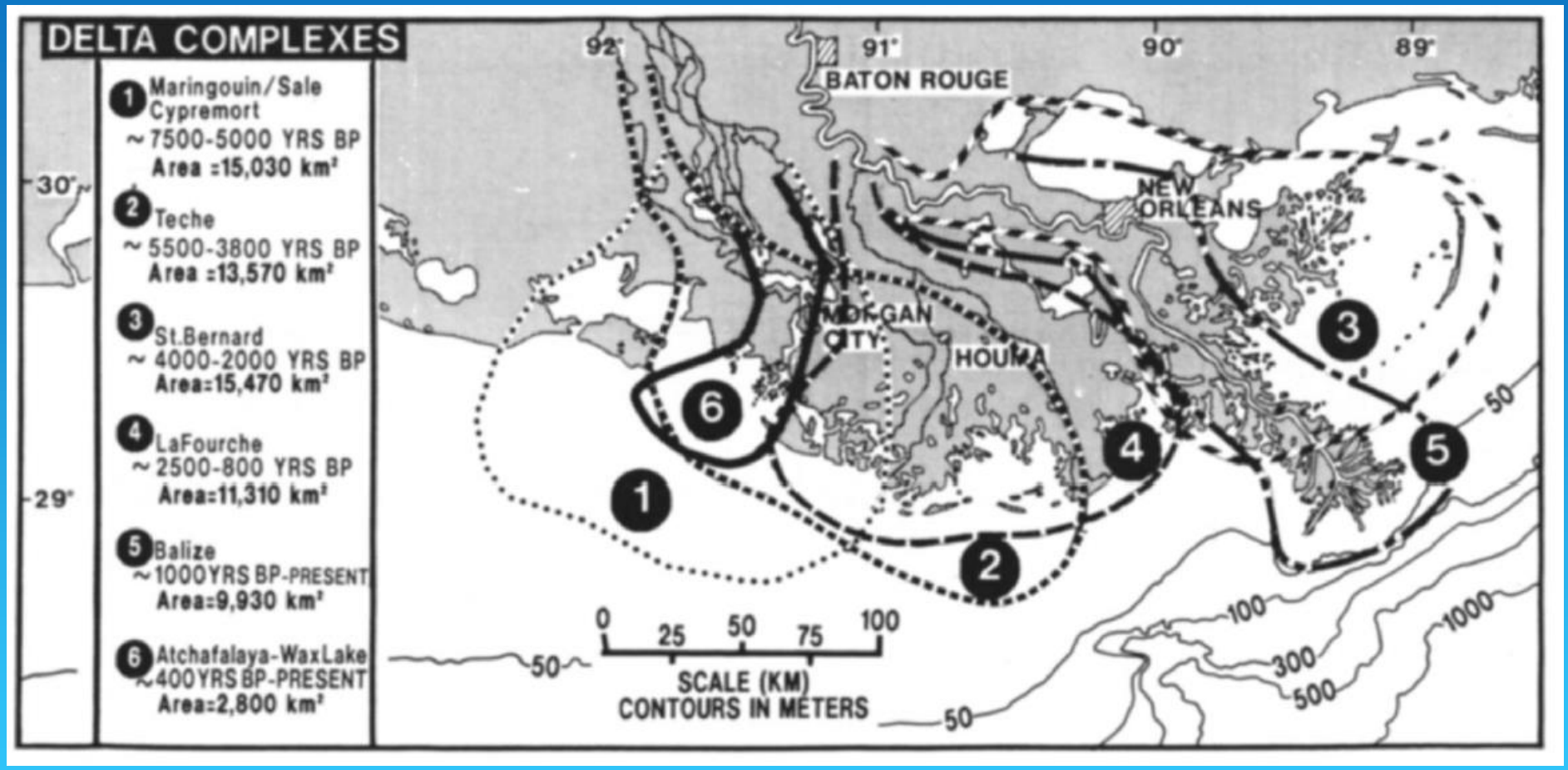
Nearest oil well is 2000 meters from seeps



Denham Springs city wells
Are closer to oil and gas wells
And still have acceptable water

4) Possible Water Sources
c) surface water

This is the only likely source of water for the high chloride concentration values observed in seep waters. Major storm events would drive chloride rich water up the Amite River allowing this water to infiltrate the soil in the Amite River plain as reservoir of chloride available to mix with other waters, rain water and local shallow aquifer water to yield the relatively high chloride concentrations. Above concentrations observed in other ground waters in Livingston Parish



Source, is Roberts (1997)

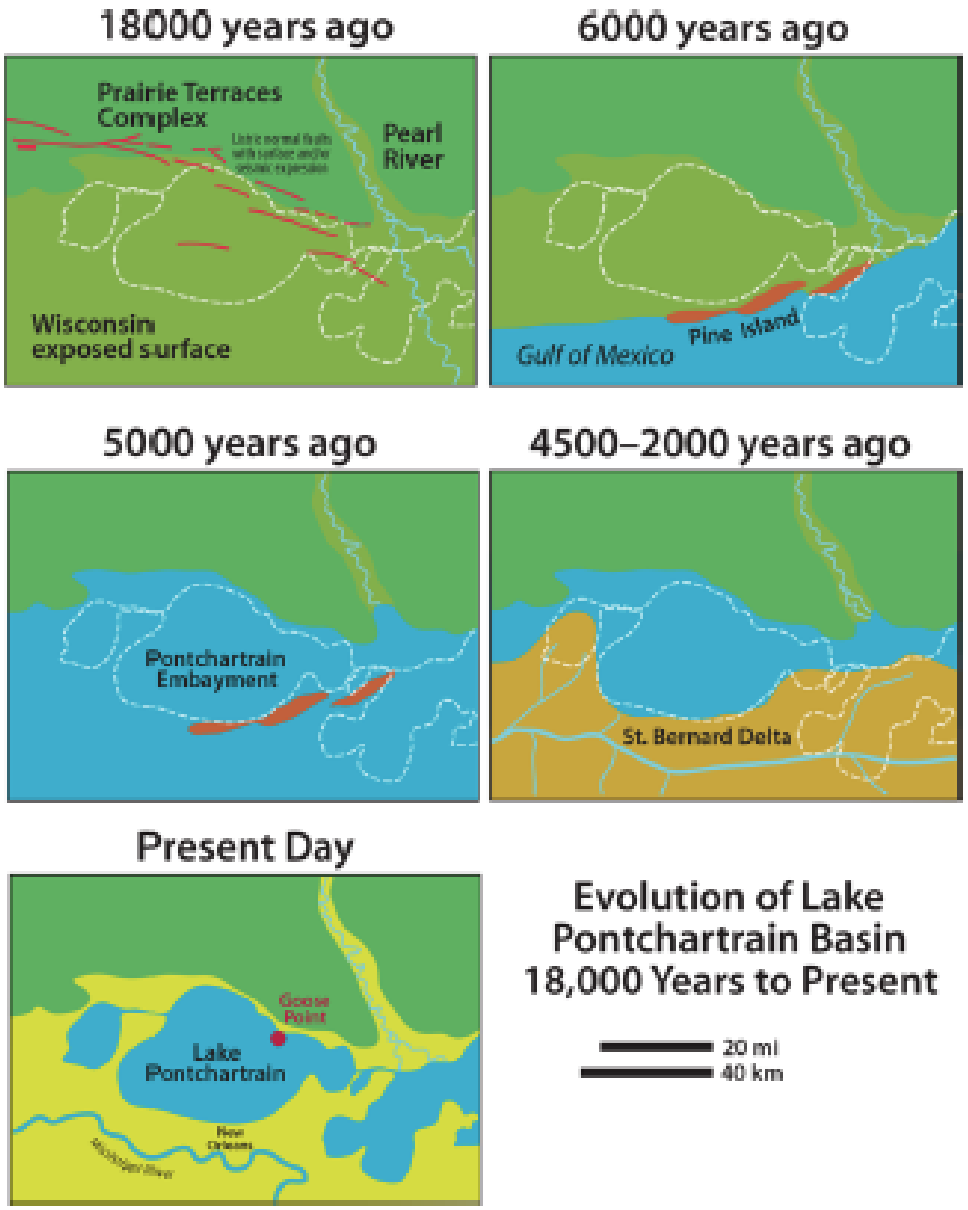
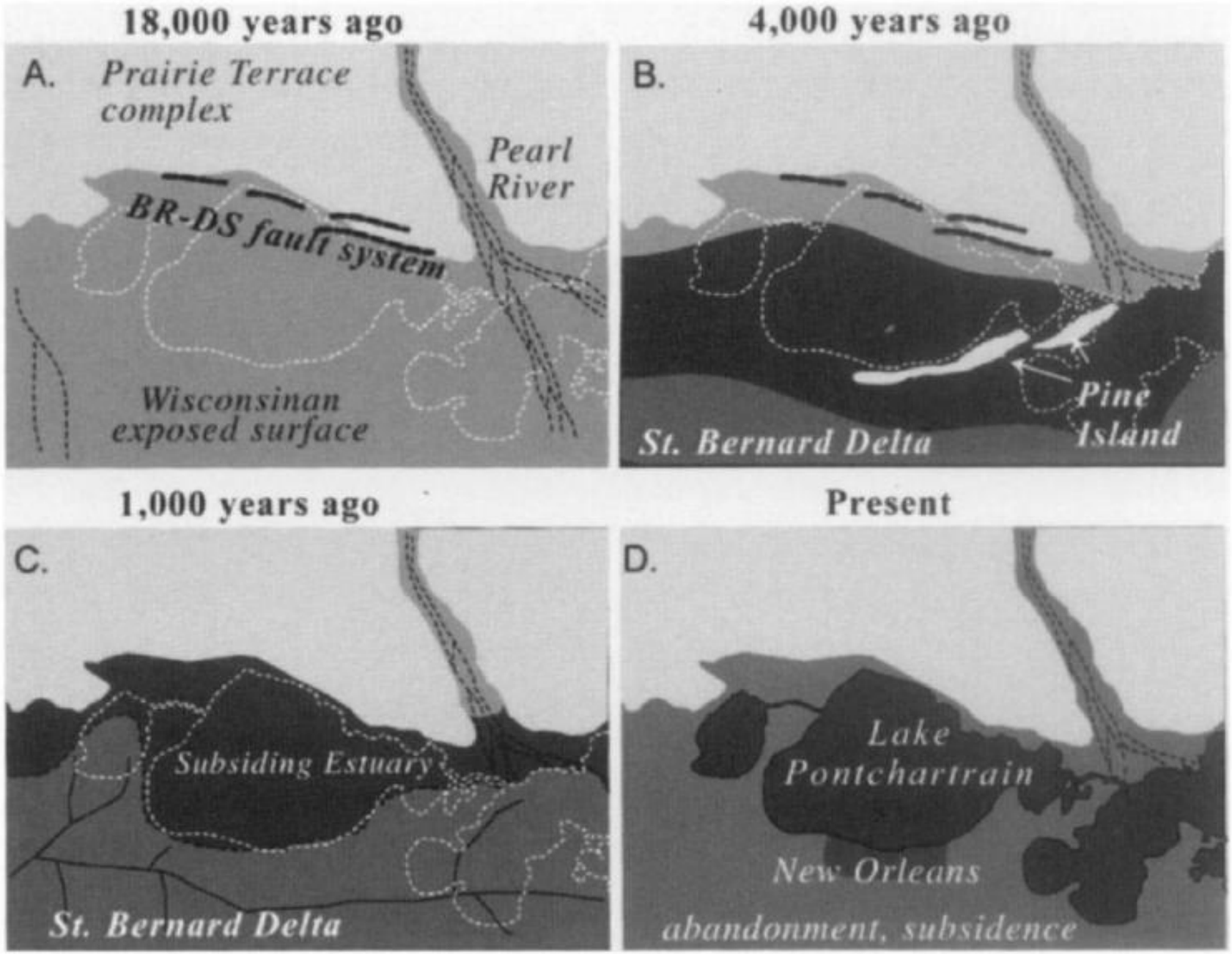


Figure 5. Evolution of Lake Pontchartrain (modified after Kindinger, 1998b).

Figure is from Haggar (2014)


18,000 years ago
A.
Prairie Terrace complex
Pearl River
BR-DS fault system
Wisconsinan exposed surface
4,000 years ago
B.
Pine Island
St. Bernard Delta
1,000 years ago
C.
Subsiding Estuary
St. Bernard Delta
Present
D.
Lake Pontchartrain
New Orleans
abandonment, subsidence

5) Summary/conclusions

1) There are 3-5 additional seeps depending on season observed near the Spring Park seep that has a cement cistern around it.

2) The chemistry of seep water is very different from city water, especially the seep has a far higher concentration of chloride than city water.

3) Seep water has higher concentrations of chloride and other other ions than any of the groundwater sources from any of the Southern Hills Aquifer System sands.

4) For this reason there must be at least some water from a surface water source or leachate from a leaking oil or gas well due to a poor casing/cement job

5) Summary/conclusions continue

5) The it highly unlikely the faulty oil or gas is highly unlike due to a distance to nearest well is over 2 km ~ mile and closer city wells have not been impact

6) The seep water is most likely mixture of local surface sand groundwater and storm surge water driven up the Amite River.

References:

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Wikipedia, 2019, North Magnetic Pole: https://en.wikipedia.org/wiki/North_Magnetic_Pole

Plat map showing possible hotel locations pair of lots numbered 710 and lot 1712 for the study (base map from Livingston Parish Assessor, 2018).