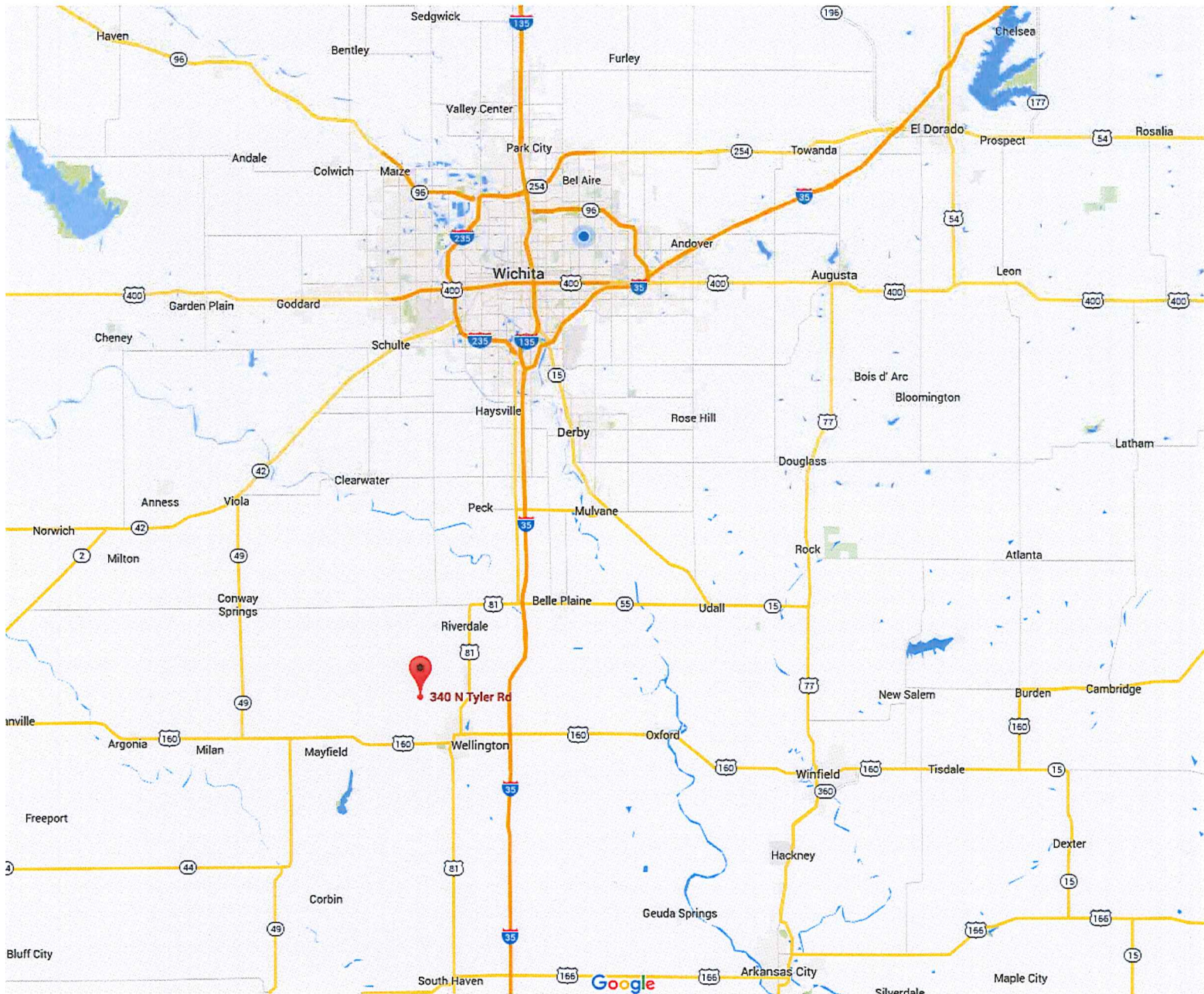


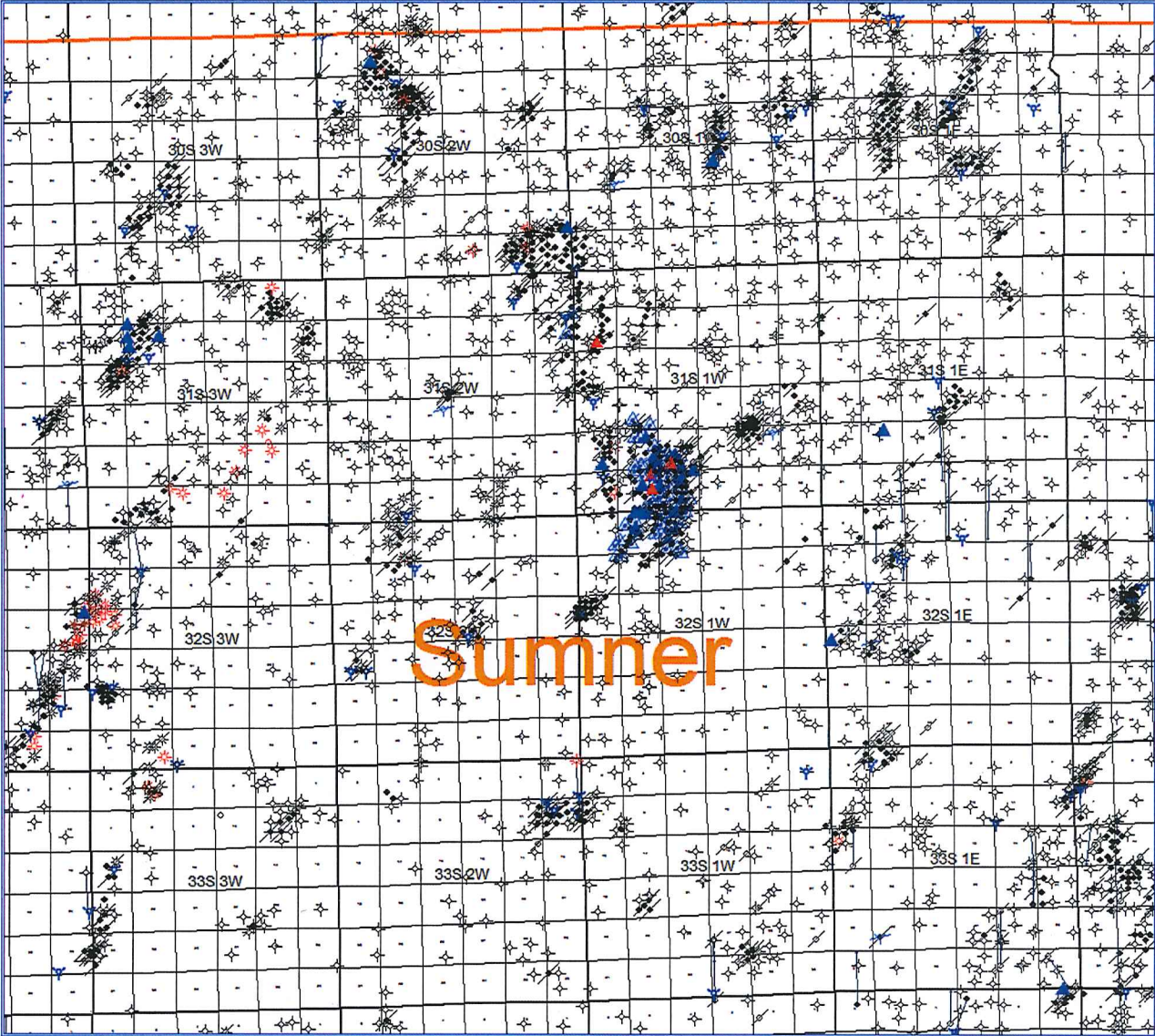
KU Wellington Field Trip

April 19, 2016

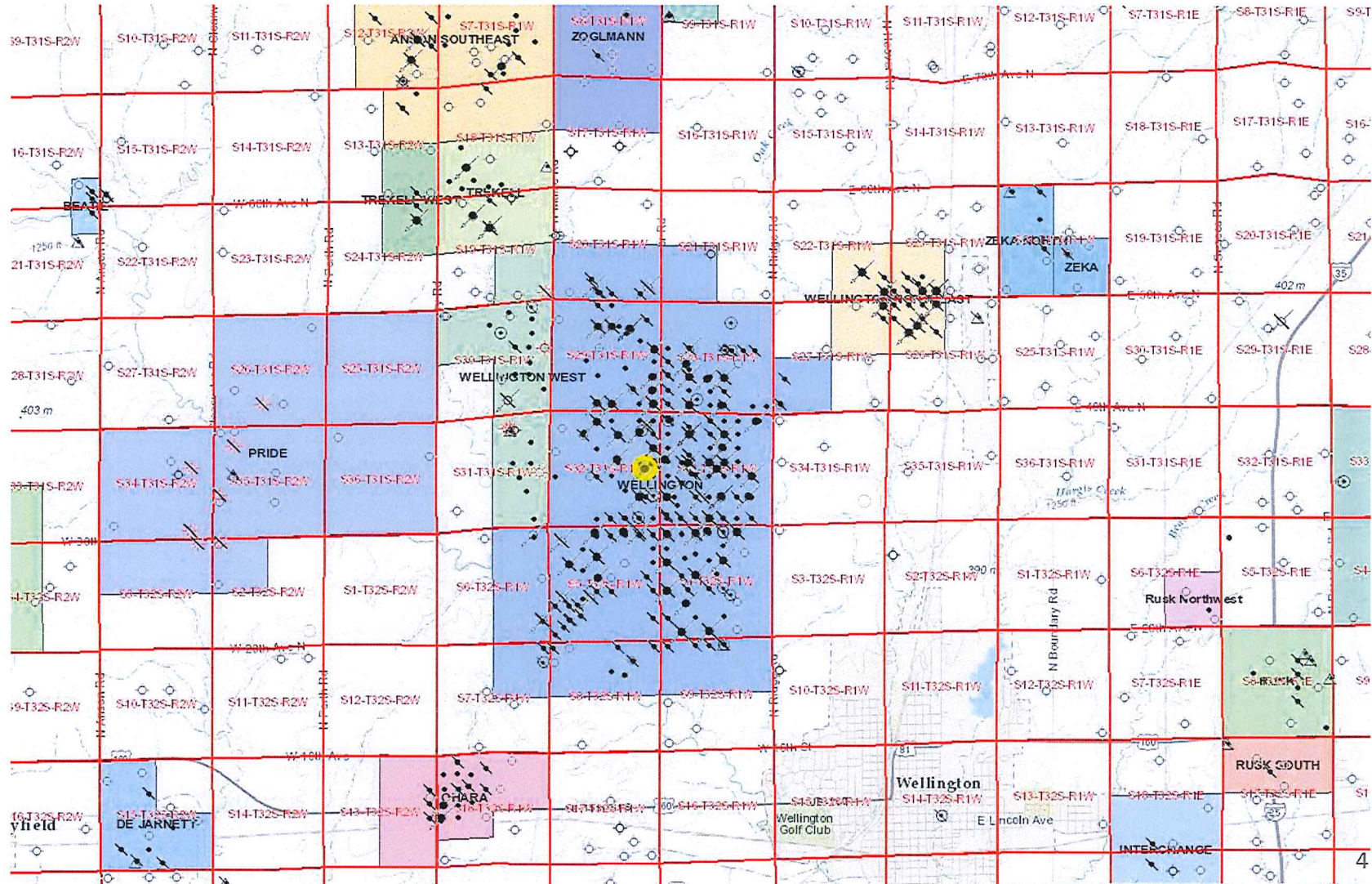
- Berexco Operated Wellington Unit is an active waterflood.
- Wellington Unit is the site of a DOE sponsored CO₂ Injection research project in conjunction with the Kansas Geological Survey.
- Site visit will include the CO₂ injection site, producing oil wells, and a waterflood injection plant and tank battery.



Wellington Field Area



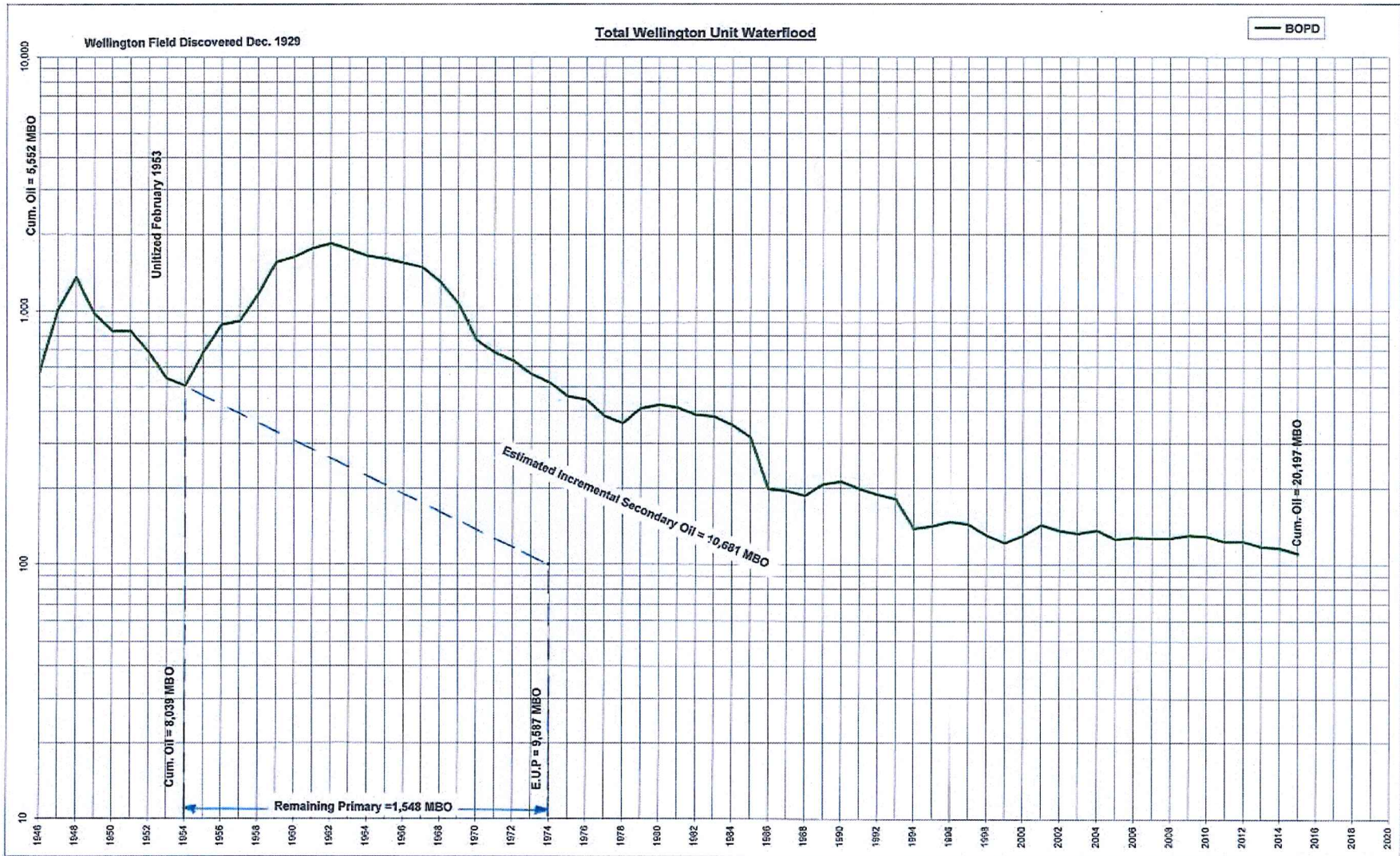
Wellington Field Area



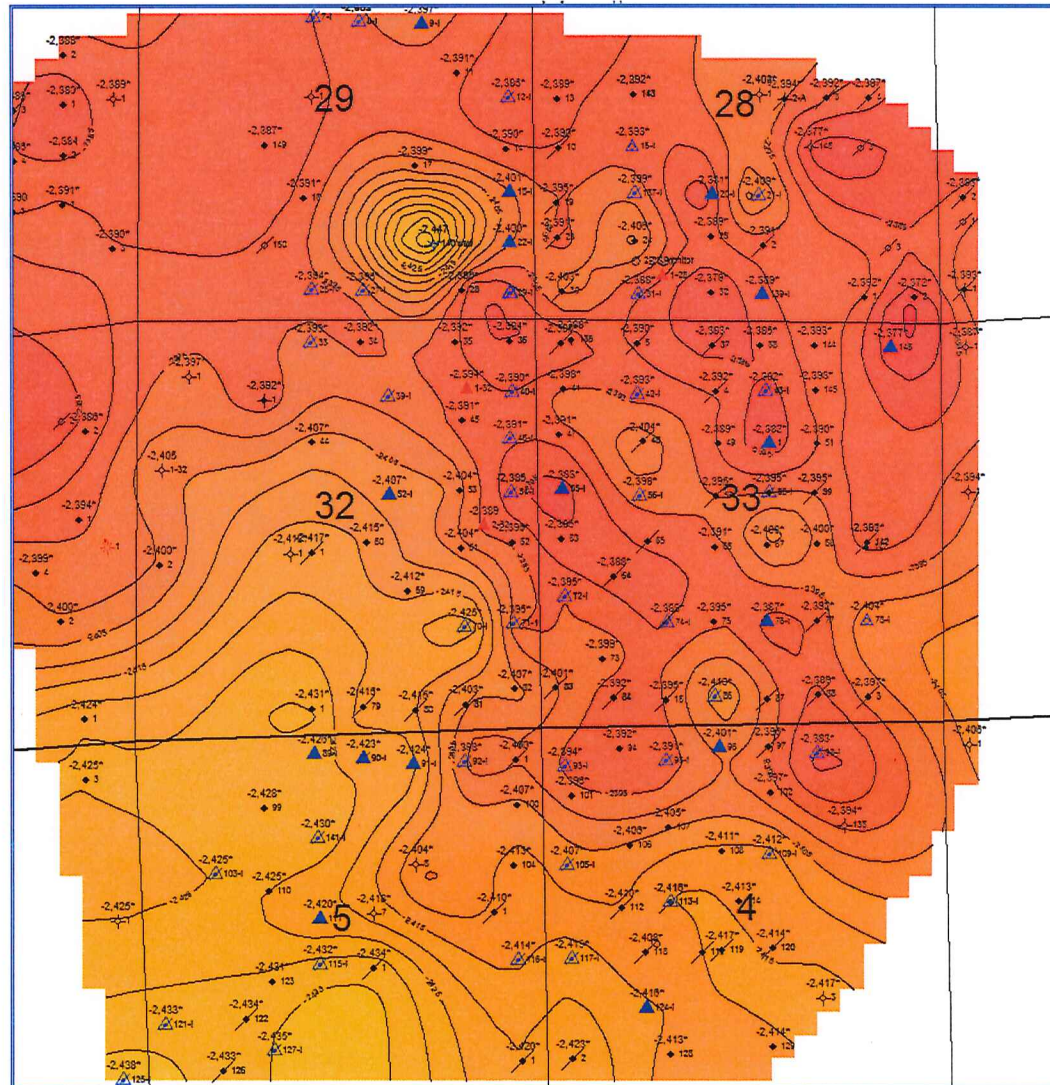
Wellington CO2 Overview

- Two Phases: CO2 EOR and CO2 Disposal.
- Phase 1: EOR pilot test in Mississippian Formation at 3600' depth. Budget \$4.0MM
- Phase 1 goals: demonstrate oil recovery from CO2 injection in Mississippi formation, which has never been done.
- Phase 1 is about ½ complete. Expenditures through 4/1/16 are \$2.2MM. Largest expenditures are purchase of CO2 (\$1MM) and drilling KGS 2-32 CO2 injection well (\$0.5MM).

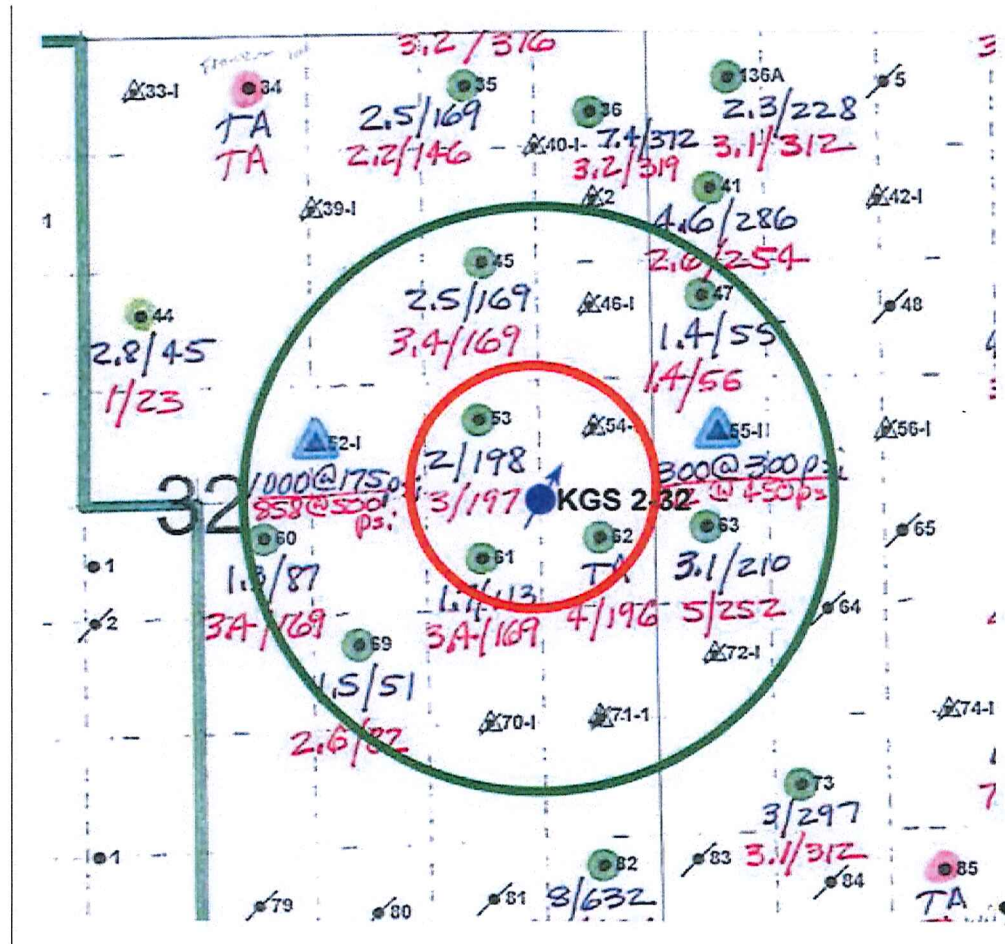
Wellington Unit Production History



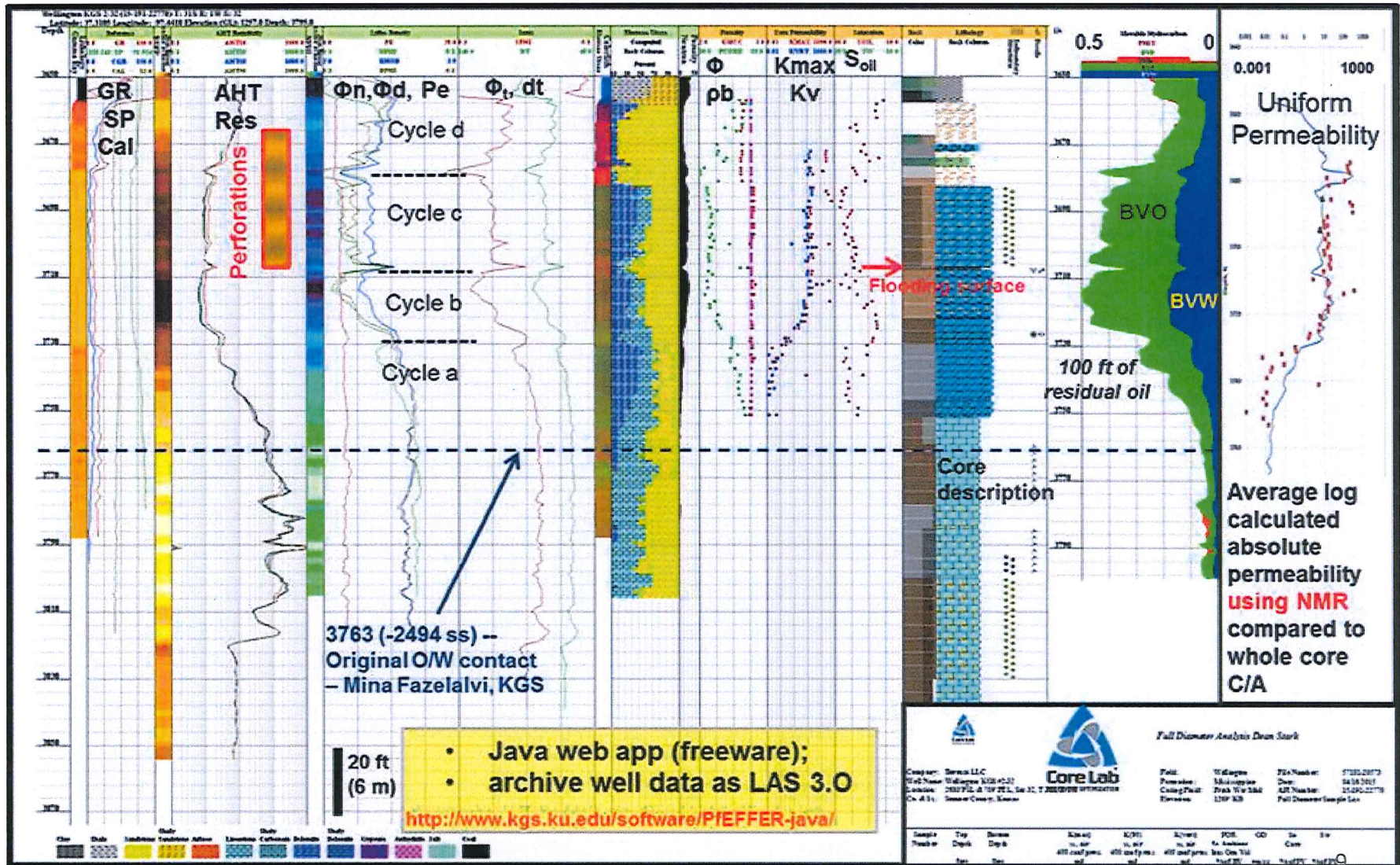
Wellington Mississippian Structure



Wellington CO2 Project



Mississippian Reservoir



Mississippian Core Data



Company: Berexco LLC
 Well Name: Wellington KGS #2-32
 Location: 2680'FSL & 709'FEL, Sec 32, T 31S, R 1W
 Co. & St.: Sumner County, Kansas

Field: Wellington
 Formation: Mississippian
 Coring Fluid: Fresh Wtr Mud
 Elevation: 1269' KB

File Number: 57181-20573
 04/01/2015; 06/11/2015
 API Number: 15-191-22770
 Analyst: JS, SO

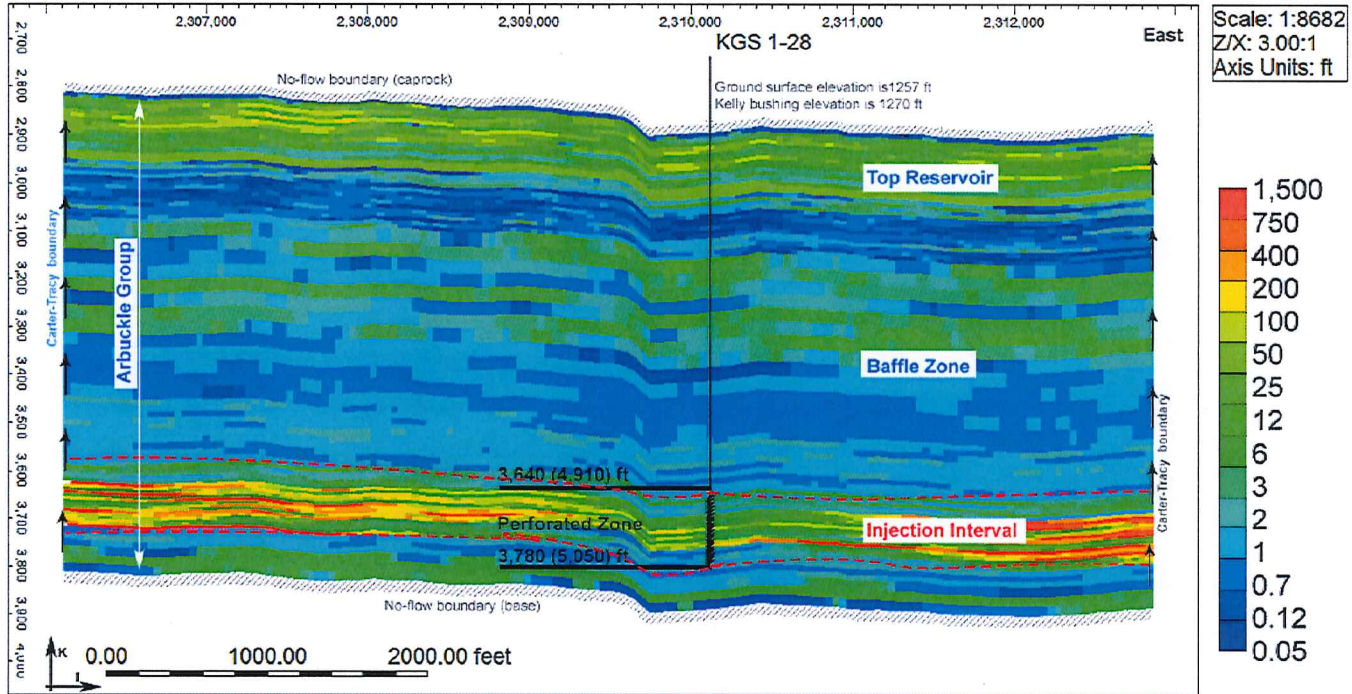
Sample Number	Top Depth (ft)	Bottom Depth (ft)	K _{MAX} Air (md)	K _{MIN} Air (md)	K _{VERT} Air (md)	POR (He) (% of BV)	GD (gm/cc)	So (% of PV)	Sw (% of PV)	Description
1	3657	3658		0.280		6.3	2.68	1.4	95.1	Cgl, dk gry, 0% flu 0% stn
2	3658	3659		0.001		3.2	2.63	5.3	88.0	Cht, frac, 0% flu 0% stn
3	3660	3661		0.001		10.7	2.64	6.4	87.2	Cht, cly, brec, 0% flu 0% stn
4	3662	3663		0.001		9.7	2.63	5.6	90.3	Cht, cly, brec, 20% yel flu 10% stn
5	3664	3665		0.001		4.8	2.63	17.7	76.8	Cht, frac, 1% yel wht flu in frac, 25% stn
6	3665	3666		0.034		15.2	2.62	21.1	72.4	Cht, cly, brec, 50% yel flu 50% stn
7	3666	3668		0.002		8.4	2.61	17.1	80.0	Cht, cly, sl brec, 30% yel flu 15% stn
8	3670	3671		0.001		19.8	2.62	13.2	84.7	Cht, cly, sl dol, brec, 20% yel flu 20% stn
9	3672	3673	217	210	15.6	19.1	2.62	14.5	82.4	Cht, dol, sl cly, brec, 40% yel flu 35% stn
10	3673	3674	199	154	10.3	19.9	2.62	11.7	84.2	Cht, dol, sl cly, brec, 45% yel flu 30% stn
11	3674	3675	217	162	12.5	14.1	2.61	4.3	93.6	Cht, dol, tr cly, brec, 35% yel flu 10% stn
12	3675	3676	213	197	6.72	16.0	2.61	9.7	88.8	Cht, dol, tr cly, brec, 40% yel flu 10% stn
13	3677	3678	15.5	13.4	10.2	27.3	2.61	19.5	72.1	Cht, dol, tr cly, brec, 95% yel flu 80% stn
14	3678	3679	118	110	12.6	30.3	2.61	18.1	74.0	Cht, dol, brec, 95% yel flu 70% stn
15	3679	3680	20.4	17.0	9.23	30.2	2.61	17.4	66.0	Cht, dol, brec, 85% yel flu 70% stn
16	3681	3682		0.002		18.9	2.62	12.1	84.0	Cht, sl dol, sl brec, 40% yel flu 20% stn
17	3683	3684	22.4	22.0	15.1	25.7	2.79	23.8	68.3	Dol, sl cht, 60% yel flu 95% stn
18	3684	3685	211	206	18.5	26.0	2.79	25.8	64.5	Dol, sl cht, 60% yel flu 90% stn
19	3685	3686	307	272	19.6	24.8	2.80	24.9	65.3	Dol, sl cht, 80% yel flu 90% stn
20	3687	3688	543	282	12.0	25.4	2.80	26.1	62.1	Dol, sl cht, 90% yel flu 90% stn
21	3689	3690	14.7	14.2	9.50	24.3	2.79	27.1	61.6	Dol, sl cht, 90% yel flu 90% stn
22	3690	3691	13.5	9.35	4.89	20.0	2.79	20.4	67.7	Dol, cht, 75% yel flu 90% stn
23	3691	3692	15.5	15.1	7.31	22.8	2.78	21.3	62.1	Dol, sl cht, 60% yel flu 90% stn
24	3692	3693	11.0	10.3	8.25	23.5	2.77	22.7	61.9	Dol, sl cht, 60% yel flu 85% stn
25	3694	3695	15.5	15.5	9.52	23.2	2.79	25.1	63.2	Dol, sl cht, 65% yel flu 85% stn
26	3695	3696	11.3	11.3	6.90	24.2	2.80	22.8	63.1	Dol, sl cht, 65% yel flu 95% stn
27	3697	3698	18.6	16.5	8.93	23.0	2.79	24.2	65.4	Dol, cht, 70% yel flu 95% stn
28	3698	3699	16.2	14.8	10.9	24.3	2.77	20.4	68.1	Dol, cht, 75% yel flu 85% stn
29	3699	3700	10.2	9.69	5.65	21.9	2.76	19.9	70.3	Dol, cht, 70% yel flu 85% stn
64	3700	3701	333	10.4	0.580	12.7	2.73	22.3	70.2	Dol, cht, 30% yel flu 35% stn
30	3701	3702	19.4	19.2	20.7	24.3	2.76	17.7	71.8	Dol, cht, 70% yel flu 80% stn
31	3701	3702	37.9	20.4	9.82	23.1	2.76	19.2	68.6	Dol, cht, 70% yel flu 75% stn
32	3703	3704	17.8	17.4	16.2	24.9	2.75	18.0	70.4	Dol, cht, 65% yel flu 85% stn
33	3704	3705	21.2	20.7	10.8	25.0	2.76	20.4	67.2	Dol, cht, 55% yel flu 85% stn
34	3705	3706	9.40	9.25	6.82	24.7	2.76	19.2	70.4	Dol, sl cht, 65% yel flu 90% stn

Phase 2 CO2 Disposal

- Phase 2: Deep CO2 Disposal in Arbuckle Formation at 5100' depth. Budget \$4.15MM
- Phase 2 goals: demonstrate CO2 can be safely disposed (sequestered) in the Arbuckle Formation.
- Phase 2 will start in 2017 but waiting on disposal permit from USEPA.
- Previously Berexco drilled two deep wells to the basement to characterize the Arbuckle reservoir, one of which will be the CO2 disposal well.

Arbuckle Reservoir Cross Section

Permeability Model (K90): Vertical Cross Section A



KGS 2-32 Drilling Phase

- 3/20/15 Spud well 7:00 am, 3/20/2015. TD 17-1/2" conductor hole @ 140' KB, 3/20/2015. Survey 1° @ 140'. Ran 3 jts 13-3/8" 48# conductor casing- set @ 137' KB. Cemented with 145 ss Class A cement with 1/4# flakes and 3% CC. Finished cementing 1:15 pm, 3/20/2015. Cement circulated to surface.
- 3/21/15 Drilling @ 465'. TD 12-1/4" surface hole @ 650' KB, 3/21/15. Survey 1° @ 650'. Ran open hole logs in surface hole- LTD @ 653' KB. Log showed base of conductor @ 142' KB. Ran 15 jts 8-5/8" 24# surface casing. Set @ 647' KB. Cemented with 175 ss 60/40 POZ 6% gel 1/4# flakes 3% CC tailed with 150 ss Class A with 1/4# flakes and 3% CC. Plug landed 8:15 pm, 3/21/15. Cement circulated to surface.
- 3/22/15 Drilling out of surface casing.
- 3/23/15 Drilling @ 1470'. Survey 3/4° @ 1164'.
- 3/24/15 Drilling @ 2325'. Surveys 1/2° @ 1670, 3/4° @ 2179'.
- 3/25/15 Drilling @ 3135'. Surveys 3/4° @ 2624', 1/4° @ 3134'. Displaced mud system at 2815'.
- 3/26/15 Conditioning hole for coring. Reached core point @ 3654' KB 6:15 am, 3/26/2015. Survey 1/2° @ 3654'. TIH w/ coring tools. Cored from 3654' to 3669' and core barrel jammed. TOH w/ Core #1. Recovered 15' of core. TIH and resumed coring- core barrel jammed @ 3691'. TOH w/ Core #2. Recovered 22' of core.
- 3/27/15 Coring @ 3691'. Cored to 3751'. Recovered 60' of core. Ran DST #1:
 DST #1, 3671'-3751', Mississippi
 Times: 30-60-60-120
 IFP: 51-235# FFP: 231-392#
 ISIP: 955# FSIP: 959#
 Recovery: 300' VSOSMW (Tr O, 95% W), 120' VSOSWM (Tr O, 35% W), 120' M;
 Chlorides 95,000 ppm
- 3/28/15 Drilling @ 3765'. TD well @ 3860' 2:00 pm, 3/28/15. Survey 1/4° @ 3860'.
- 3/29/15 Running open hole logs- LTD @ 3860' KB. Lay down drill pipe and drill collars. Ran 95 jts 5-1/2" 15.5# casing. Tag TD @ 3860' KB and set casing @ 3858' KB. Circulated halfway into hole and on bottom. DV @ 2515' KB. Baskets @ 3732', 3608', on jt below DV tool and at 1000'. Ran centralizers every other collar up to 3000' and on joints above and below DV tool.
- 3/30/15 Cemented bottom stage with 95 ss A-Con w/ 1/4# flakes and 2% CC mixed at 2.01 cu ft/ss tailed with 195 ss AA-2 thixotropic cement with 5% Calseal, 1% C-44 Gas Blok CO₂ resistant additive, 10% salt, 1/4# defoamer, 1/4# flakes 1/2% fluid loss, 0.3% CFR-2, and 6# gilsonite. Plug landed 2:10 am, 3/30/15. Opened DV tool and circulated 4 hours. Saw cement from bottom stage circulate to surface. Cemented top stage with 465 ss A-Con w/ 1/4# flakes 2% CC at 2.01 cu ft/ss and 50 ss AA-2. Plug landed 7:20 am, 3/30/15. Cement circulated to surface. Plugged mouse and rat holes with 50 ss A-Con. Rig released 3/30/15
- 3/31/15 Waiting on completion.

KGS 2-32 Completion

- 4/22/15 MIRU BX Rig #13. TIH w/ 4-7/8" bit, 3- 3-1/8" drill collars and 2-7/8" workstring. Tag DV @ 2515' KB. Drill out DV tool. Tag PBD @ 3820' KB. Circulated hole clean with fresh water. SOH w/ tubing, drill collars and bit. Shut down.
- 4/23/15 FOH w/ tubing and bit. Ran CBL- PBD @ 3815' KB. Good bond from TD to surface. Pressured casing to 2500#- held. TIH w/ 4-7/8" bit, 5-1/2" casing scraper and 2-7/8" workstring to 3780' KB. Shut down.
- 4/24/15 Swab casing fluid level down to 3150' from surface. TOH w/ bit, scraper and tubing. Perforate Mississippi Chert from 3664'-3706' KB, 4 SPF. Shut down.
- 4/25-26/15 Shut down.
- 4/27/15 Ran 5-1/2" X 2-7/8" Arrowset PKR. Set @ 3638' KB. Ran swab- fluid level 1800' from surface, 100' free oil on top. Recovered 10.8 BW on swab down. Had 700' fill up after 1 hour. Acidized Mississippi perms with 2500 gallons 10% NEFE-HCl and 250 ball sealers. Treated 3 BPM @ 1300# initially, increased to 5.7 BPM @ 700# towards end. ISIP 50#, 30 seconds to vacuum. TLTR 90 BTF. Ran swab- fluid level 1100' from surface. Recovered 44.7 BW on swab down. Next hour recovered 20.8 BTF with trace oil. Shut down.
- 4/28/15 Ran swab- fluid level 2000' from surface, 50' oil on top. Swabbed 26.7 BTF. Release PKR and run across perms to remove any remaining ball sealers. Reset PKR @ 3638' KB. Ran swab. Recovered 16.8 BTF on swab down.
- | | |
|----------------------|--|
| 1 st Hour | 19.1 BTF, fluid level 2800' from surface |
| 2 nd Hour | 23.4 BTF |
| 3 rd Hour | 16.7 BTF |
| 4 th Hour | 13.4 BTF |
| 5 th Hour | 13.4 BTF |
| 6 th Hour | 20 BTF. Fluid level stayed 2800' from surface. Caught fluid samples. |
- Shut down.
- 4/29/15 Ran swab- fluid level 2000' from surface, 75' free oil on top. Injected 2 BPM for 10 minutes- took fluid on vacuum. Injected 4 BPM for 10 minutes- stabilized pressure 150#. TOH w/ tubing and PKR. RDMO BX Rig #13.

KGS 2-32 Start of Injection

6/8/15 MIRU Contract WS Rig. TIH w/ nickel coated Arrowset-1X PKR with Viton rubber and 1.875" stainless steel profile nipple for X-style blanking plugs, nickel coated on-off tool and 110 jts TK-70XT coated tubing. Pump packer fluid and set PKR @ 3636' KB. Annulus held 150#. RDMO Contract WS Rig. Will MIT well 6/10/15.

6/10/15 MIT well to 350#- held. Witnessed by Jonathan Hill of KCC District #2 office.

6/23/15 Permit for carbon dioxide injection approved by KCC.

7/7/15 Installed 2" 2250# fiberglass water injection line from Wellington Unit #52I injection well to Wellington KGS #2-32 well.

7/27/15 Waiting on high pressure stainless steel fittings to finish hooking up wellhead.

8/3/15 Finished hooking up wellhead and began injecting water. Instantaneous rate 300 BWIPD @ 0# tubing pressure. Backed rate off to 115 BWIPD.

8/27/15 Injecting 115 BWPD on vacuum.

9/22/15 Injecting 111 BWPD on vacuum.

10/1/15 Shut in Wellington Unit producing wells #53, #61 and #62 to raise reservoir pressure around KGS #2-32. Injecting 115 BWPD on vacuum.

10/5/15 Injecting 115 BWPD average on vacuum. BHP on offset wells: #53 at 1066 psi, #61 at 732 psi, #62 at 961 psi.

10/12/15 Injecting 115 BWPD average on vacuum. BHP on offset wells: #53 at 1222 psi, #61 at 910 psi, #62 at 1100 psi.

10/19/15 Injecting 115 BWPD average on vacuum. BHP on offset wells: #53 at 1254 psi, #61 at 1007 psi, #62 at 1163 psi.

10/26/15 Injecting 115 BWPD average on vacuum. BHP on offset wells: #53 at 1301 psi, #61 at 1072 psi, #62 at 1209 psi.

11/1/15 Increased injection to 250 BWPD- well still on vacuum.

11/2/15 BHP on offset wells: #53 at 1316 psi, #61 at 1120 psi, #62 at 1240 psi.

11/23/15 Finishing pad for injection skid and working on electric hookup.

12/1/15 Injecting 250 BWPD on a vacuum. #53 at 1394 psi, #61 at 1234 psi, #62 at 1333 psi.

12/8/15 Injecting 250 BWPD on a vacuum. #53 at 1394 psi, #61 at 1250 psi, #62 at 1348 psi.

12/18/15 Increase injection to 500 bwpd. Move in first CO2 storage tank.

12/23/15 Move in one transport truckload of CO2. Hook up truck to suction side of Berexco CO2 injection pump. Pump 17 US tons of CO2 down the KGS 2-32 CO2 injection well using the CO2 injection pump over 2.5 hours total. Starting pressure 500 psi, final injection pressure 300 psi. Resume water injection. Total CO2 pumped down well 34,135 lbs. Max rate 1750 bbl per day rate at 300 psi, which is approx 310 tons per day. Resume injection at 500 bwpd. Cumulative water injection to date: 21,894 bbl water.

12/24/15 500 bwpd

12/29/15 Begin filling CO2 storage tanks. Four 70 ton storage tanks on location.

Current CO2 Injection

3/18/16 1801 BBL CO2 injected at 166# TP. Current rate 2024 BPD. E. Nelson 32 BO
3/19/16 1416 BBL CO2 injected at 169# TP. Current rate 1892 BPD. E. Nelson 28 BO
3/20/16 1729 BBL CO2 injected at 170# TP. Current rate 1775 BPD. E. Nelson 28 BO.
3/21/16 1631 BBL CO2 injected at 167# TP. Current rate 1716 BPD. E. Nelson 28 BO
3/22/16 1872 BBL CO2 injected at 161# TP. Current rate 1822 BPD. E. Nelson 42 BO
3/23/16 1593 BBL CO2 injected at 206# TP. Current rate 1770 BPD. E. Nelson 25 BO.
3/24/16 1178 BBL CO2 injected at 180# TP. Current rate 1544 BPD. E. Nelson 32 BO.
3/25/16 1734 BBL CO2 injected at 171# TP. Current rate 1615 BPD. E. Nelson 52 BO.
3/26/16 1059 BBL CO2 injected at 180# TP. Current rate 1204 BPD. E. Nelson 30 BO
3/27/16 1336 BBL CO2 injected at 167# TP. Current rate 1620 BPD. E. Nelson 60 BO
3/28/16 1431 BBL CO2 injected at 171# TP. Current rate 1545 BPD. E. Nelson 32 BO
3/29/16 1407 BBL CO2 injected at 206# TP. Current rate 1201 BPD. E. Nelson 37 BO
3/30/16 1274 BBL CO2 injected at 211# TP. Current rate 1545 BPD. E. Nelson 33 BO.
3/31/16 1226 BBL CO2 injected at 190# TP. Current rate 1253 BPD. Switched to water due to CO2 shortage
from Linde. Cumulative CO2 injection to date 96,949 BBL. E. Nelson 33 BO
4/1/16 Injected 311 BBL CO2 before shutdown. Injected 636 BBL water @ 0# TP, current rate 821 BPD. E.
Nelson 33 BO
4/2/16 726 BW @ 0# TP. Current rate 824 BPD. E. Nelson 33 BO.
4/3/16 826 BW @ 0# TP. Current rate 837 BPD. E. Nelson 33 BO.
4/4/16 830 BW @ 0# TP. Current rate 814 BPD. E. Nelson 37 BO.
4/5/16 910 BW @ 0# TP. Current rate 778 BPD. E. Nelson -33 BO- pulled bottoms.
4/6/16 877 BW @ 0# TP. Current rate 801 BPD. E. Nelson 32 BO.
4/7/16 537 BW @ 0# TP. Current rate 628 BPD. E. Nelson 27 BO.
4/8/16 608 BW @ 0# TP. Current rate 721 BPD. E. Nelson 33 BO.
4/9/16 680 BW @ 0# TP. Current rate 735 BPD. E. Nelson 36 BO.
4/10/16 761 BW @ 0# TP. Current rate 739 BPD. E. Nelson 33 BO.
4/11/16 716 BW @ 0# TP. Current rate 698 BPD. E. Nelson 18 BO- had power outage- wells down 12 hr.

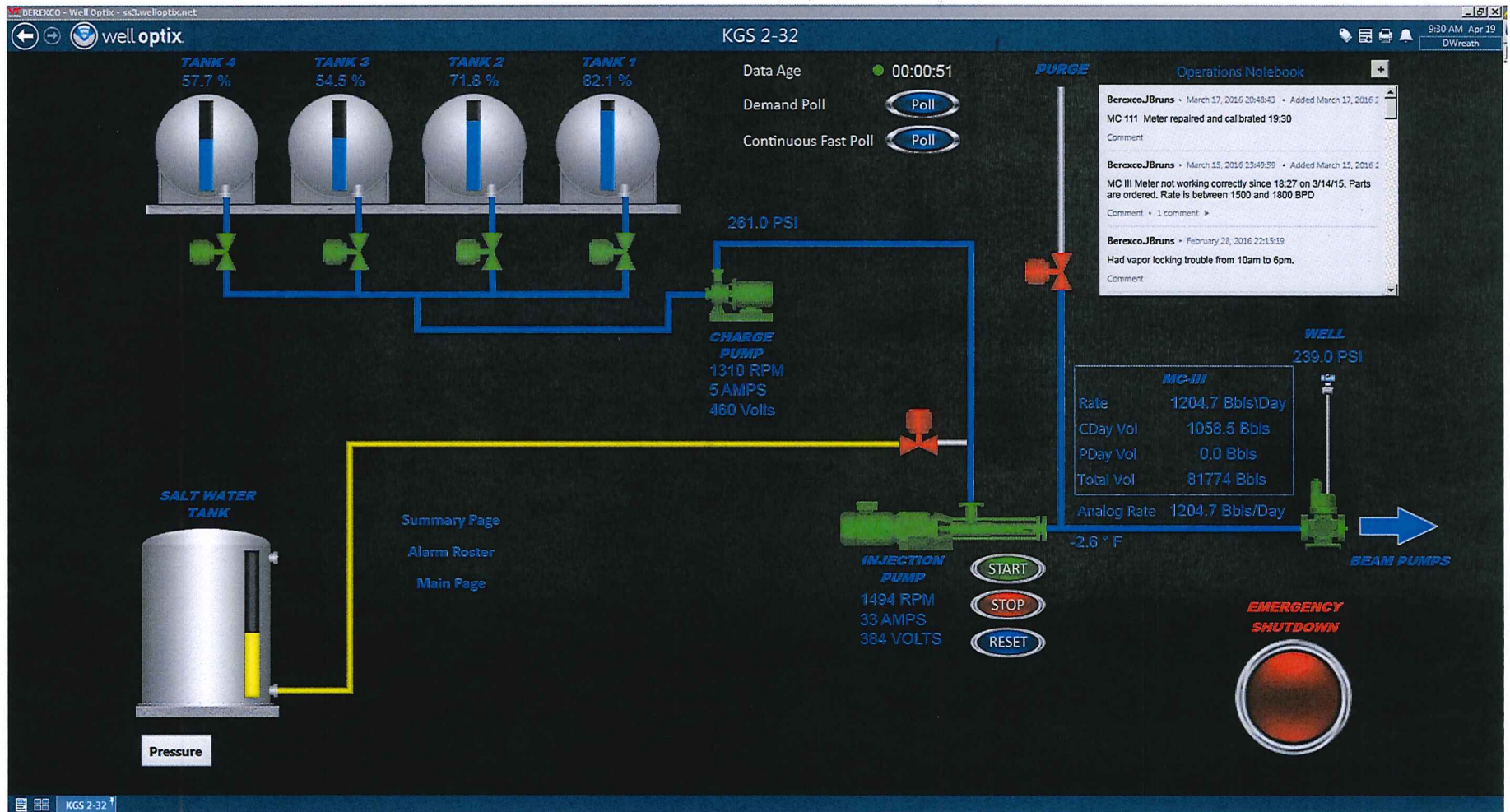
4/12/16 771 BW @ 0# TP. Current rate 795 BPD. E. Nelson 17 BO- power out part of day. Resume CO2
injection. Stop water injection.
4/13/16 1537 BBL CO2 injected at 185# TP. Current rate 1503 BPD. E. Nelson 35 BO.
4/14/16 1467 BBL CO2 injected at 214# TP. Current rate 1205 BPD. E. Nelson 23 BO.

CO2 Properties

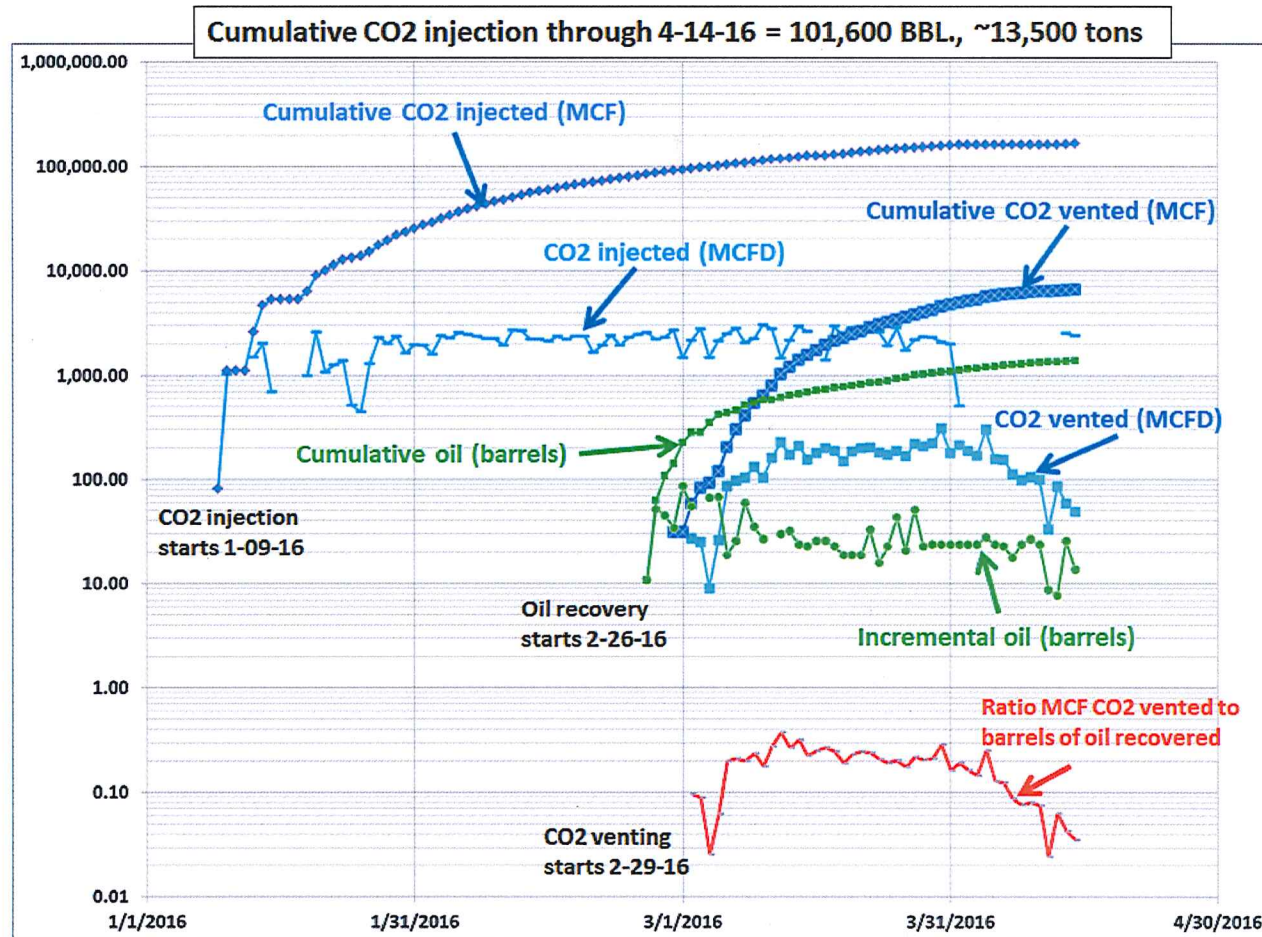
Linde LLC Data

CO2 Weight-Volume Equivalents			
Weight	Volume of Liquid @ -14 F		Volume of Gas @ 60 F, 1ATM
Pounds	Gallons	Barrels	Cubic Feet
1	0.114	.0027	8.59
8.80	1	.024	72.7
369.6	42	1	3053.6
2000	227.3	5.41	17190

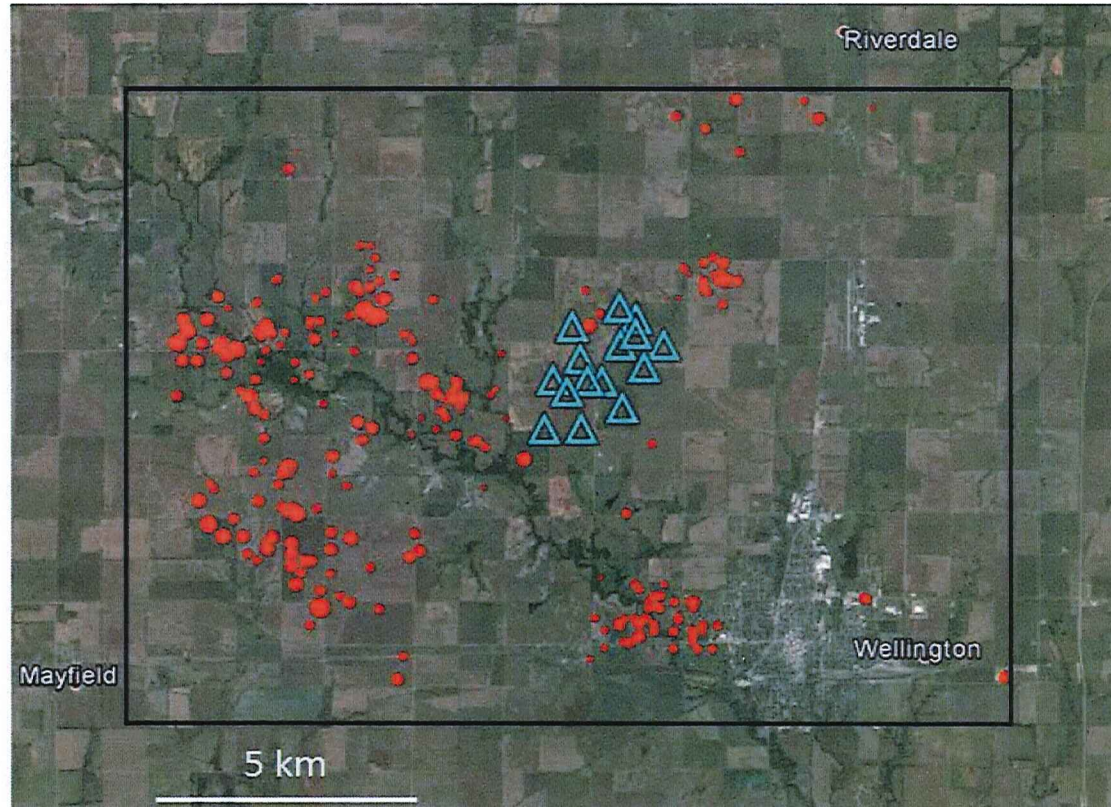
Wellington Automation System



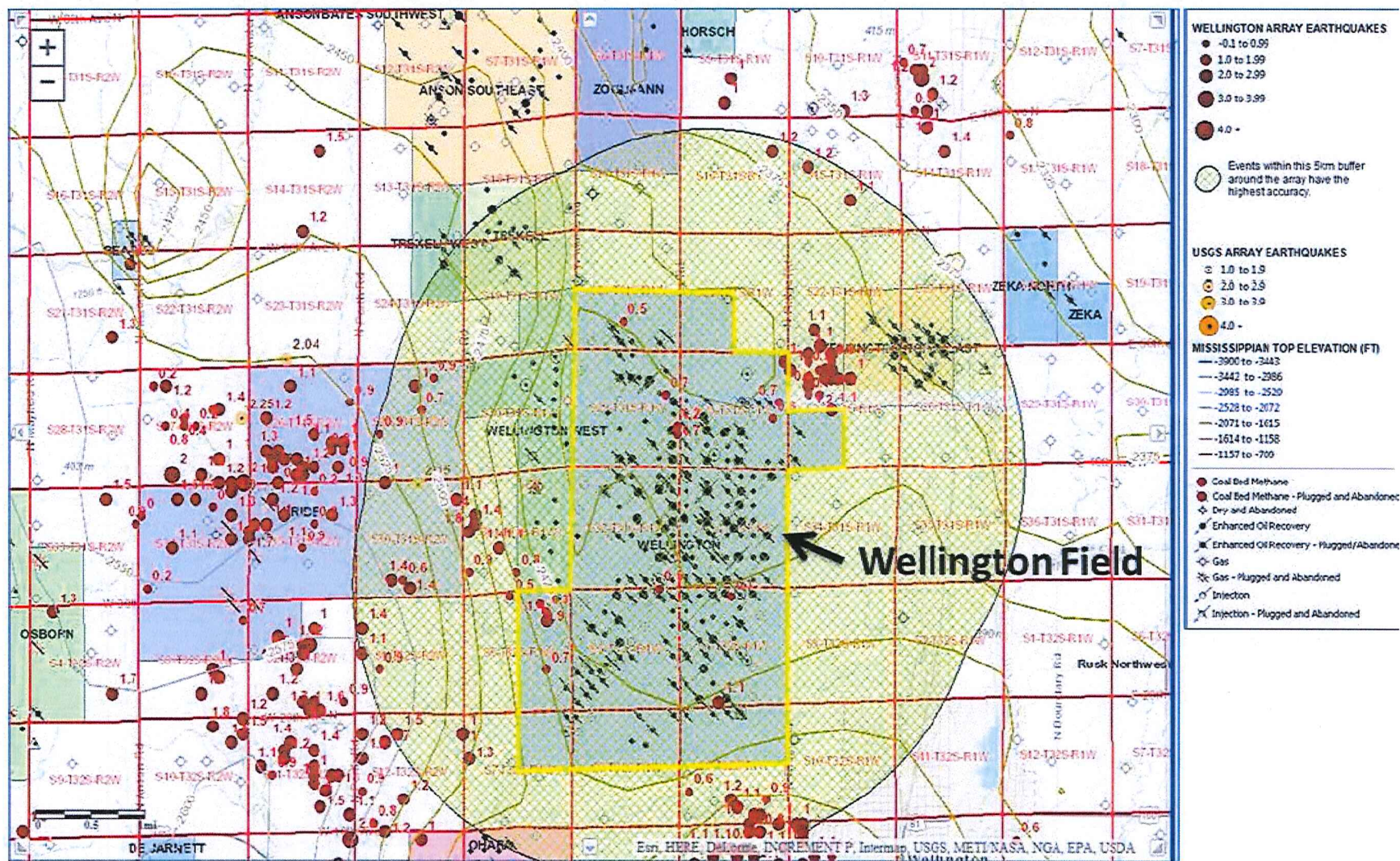
CO2 Injection Results to Date



KGS Seismometer Array



Map showing all events within the approximate area of interest. Wellington stations are the blue triangles and earthquakes are the red circles with diameter proportional to event magnitude. All events in this area were used to calculate a preliminary Magnitude of Completeness (from Nolte et al., 2016). Events range between zero and two, very small, and not recorded by regional seismic networks.



Map of Wellington Field (with yellow outline) and nearby oil fields showing location of earthquakes (red dots) detected with the Wellington seismometer array. Illustration is from the *Kansas Interactive Online Geology Mapper (KIOGM)* accessed through the KGS (<http://maps.kgs.ku.edu/co2/>). Earthquakes are labeled with magnitudes. Yellow green stippled oval area surrounding Wellington Field denotes 5 km radius of reliability beyond the edges of the Wellington seismometer array. Legend is to the left of the caption.