Antina Ranch, a Case Study

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Collectively referred to as "G-Forensic- *The Forensic Well Survey Team*"

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Introduction

Ashley Watt's Antina Ranch is located in far west Texas bordering on Ward and Crane Counties. It became more widely known because of its proximity to a giant saltwater geyser first observed in early January of 2022. While not on her ranch, the well later identified as CT-112 showcased the issues being brought to public attention on multiple ranches throughout the area.

The picture below from "Texas Monthly" shows the leakage from the CT-112 well. It became a focus of attention in Texas by highlighting the issue of orphan wells. The G-Forensic team has done a study of the well(s) directly involved with the CT-112 geyser; and the impact of a misrepresented plugged and abandoned well. Our study has been circulated to federal, state and private organizations focused on orphan wells.

Figure 1 - CT-112 Leaking Well 12/31/2021

Because of the complexity and even mystery surrounding the CT-112 well, we have extended our review to the P&A wells located on Ashley Watt's Antina Ranch, as well as those located on other ranches. The following pages outline the field work that was performed, the desktop analytical review we undertook, and our conclusions and recommendations. The reader should understand that the purpose of this report is to further the knowledge and understanding of precisely geo-locating wells, and its importance in resolving current and future plugged and abandoned wells which have the potential for surface and sub-surface failure.

In order to extend the study, we researched and located information relating to wells surrounding the general area of CT-112, concentrating our efforts on the Antina Ranch. It should be noted that there are multiple wells, both producing and P&A within the boundaries of the Antina Ranch. We chose these as there was a good mixture of producing, P&A, orphan and suspect problematic wells within the group. We were also given permission to conduct a field study of the wells within the Ranch to gather data and observe field conditions.

Multiple reports[1] have indicated that the CT-112 Geyser is possibly the biggest indicator of an even larger sub-surface problem in and around the Antina and other ranches. As of this report, Chevron as the operator of the well has yet to resolve the pressures which have prevented the successful plugging of the well; now entering its seventh month. Rumored estimates suggest millions of dollars have already been spent with projections in the tens of millions.

Ashley Watt has assembled an extensive team of experts to try and define the cause and relationship of failed and leaking wells in and around her Ranch. Our effort is to showcase the importance of knowing each well's location and how a misrepresentation of a well's geo-location is a failure just as culpable as the failures that caused these wells to leak.

Watt has pointed out multiple visible leaking wells across her Ranch and even as early as 2021, we started gathering and reviewing information; including field trips to support our efforts and to prove the messages we outlined in our initial case study.

We continually ask industry, state, and federal agencies and even landowners if knowing exactly where wells are located is important. The answer was a resounding silence…… **no response at all**. This is likely attributable to a lack of understanding, a lack of knowledge, or worse, a lack of responsibility at the corporate / institutional level.

Lack of understanding makes some sense. Leaking wells are visible so it is obvious where they are and as long as they keep leaking, they can always be found.

Lack of knowledge is much more complex as many individual and organizations do not understand that location is the key to defining relationships; coordinates define location relative to boundaries; which are also defined by coordinates. Those relationships define ownership and may in fact; determine responsibility and liability for orphan wells. Locations also define relationships to other wells and the data from each may also define causes for failure perhaps due to field operations, sub-surface management and even the basics of understanding subsurface change.

If the definition of a well's location is misrepresented it biases the data associated with that well. If there is a material misrepresentation of the geo-location then all prior and subsequent analysis of data will also be biased, and the results of consequent analytics may also be compromised.

In the case of the Antina Ranch, there are those who believe that the sub-surface; through historical production practices, and possible injection operations may have changed such that water under pressure

has pushed through sub-surface pathways and infused with sub-surface salt, may be escaping through older, poorly plugged and failing wells; e.g., P&A and orphan wells.

However, even that understanding could be biased because the actual locations of the leaking wells are largely misrepresented. An accurate geo-location obviously has a meaningful impact on how wells such as CT-112 should be remedied, but as long as it is lacks governance now or in the future, the fundamental issue of "where" remains in question. The collective lack of organizational responsibility for prioritizing geo-location falls on the shoulders of all stakeholders; the oil and gas industry, the state and federal regulatory agencies, and the individual landowners.

Too much reliance has been placed on "available" coordinates and the universal assumption that these coordinates are and always will be correct. This is demonstrably not true for any asset of any type; and especially for oil and gas wells; the legal boundaries the well locations are referenced to, and the coordinate reference systems used to describe them.

While our ability as an industry to locate things has improved immensely, our inability to retain the digital representation of location data accurately and with validation remains unchanged. If it is represented with coordinates, their values must be correct within the associated frame of reference and their spatial integrity maintained through implementation of a proper data management system. Confirming the integrity of the values in the future could possibly be more expensive than the original cost to acquire it.

The Antina Ranch is an excellent example of the issues that have been outlined in our series of case studies.

Antina Ranch AOI

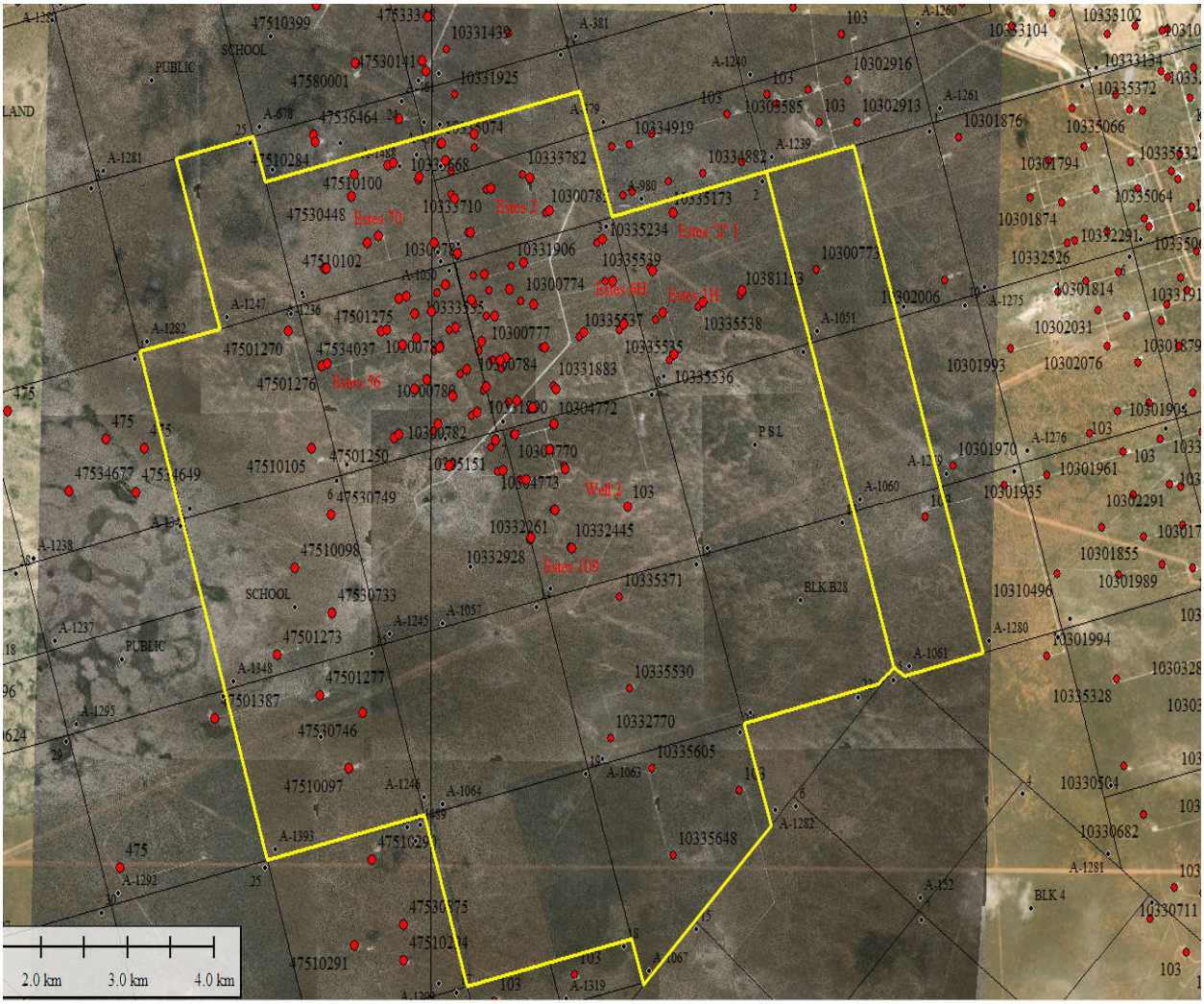


Figure 2 -Antina Ranch Area of Interest

The Study

Our involvement with the Antina Ranch began after the WA Estes 24 well made the news last fall (2021) and G-Forensic decided to do a forensic audit on WA Estes 24 and the wells in the area. We opened a dialogue with Watt and her team through Sarah Stogner to discuss doing a field well location review. Our efforts include a multifaceted approach to defining both the wells that were visible and leaking, and the wells that were visible but not leaking; and also those wells which were P&A in the past and exhibited no visible surface scars or features. The ranchers themselves, as do most people, rely on first-hand knowledge or information publicly available through the Texas Railroad Commission to locate these historical P&A wells.

Sadly, the geo-location of many of the historical wells (i.e., pre-1960) are not available in digital form and those that are, will often be misrepresented as to their true location. The reasons for this were outlined in G-Forensic team's initial document, which we encourage the reader to review for context.

Our efforts involved obtaining digital and hard copy information from multiple sources allowing us to review such things as historical imagery and land grids, well plats, old well log headers and scout tickets provided by the Midland Energy Library (MEL), legacy maps and even data mining the RRC documents. This review, combined with actual field investigations, produced anticipated results that matched expectation based on our historical studies in other areas.

In total, our Antina Ranch study involved seventy-five wells registered with the Railroad Commission. Twenty-eight wells had an existing visible feature such as a pumpjack or wellhead; thirty-nine wells were P&A; one well was permitted but never drilled. Seven wells are designated orphans (of which one was identified in records as a water well). These orphan wells were further classified accordingly as:

- 1 in RRC GIS with no API # (Exxon/IHS API # 4210300775). MEL records show well drilled in 1944, P&A 1953, Currently there is a water well (drilled by Antina Ranch) near the old wellbore location
- 3 wells on historical topo map, NO RRC or Mel records, found well pad evidence in historical 1967 imagery, one of the location look to be a tank pad and not a well pad
- 2 Core Test wells (CT-105 & 106) found in MEL records, possible well pad evidence found in historical 1967 imagery, CT-105 found on well plat for WA Estes 115 in section 8, CT-106 found on well plat for WA Estes 114 in section 13.
- 1 Strat test well (ST-107) found on well plat for WA Estes 114 in section 13 (found both wells in MEL records for CT-106 and ST-107 in section 13)

Finding wells relies on multiple information sources and factors. Firstly, there is the available surface hole geo-location data, which the G-Forensic team has determined from our studies to be extremely unreliable. Secondly there is visible evidence, which over time through natural processes becomes less and less viable. Beyond the foregoing records, forensic efforts are required to determine the geo-locations which quickly become highly complex, particularly extensive time periods are involved, and must be conducted by experienced spatial data professionals. Results of our efforts have determined that once orphan wells are discovered and remediated, the locations are almost never properly determined or preserved and

continue to remain misrepresented in digital form. As time passes, the physical evidence of their location disappears and they become the most difficult wells to identify and locate.

Well Summary

	Summary	Crane County	Ward County	# of wells
	Wells	**63**	**12**	**75**
	PJ/WH	23	5	28
	P&A	32	7	39
	Not drilled	1		1
	Orphan	7	0	7
Orphan	RRC- no API	1	0	1
breakdown	Not in RRC	6	0	6
Note: 31 of the 75 wells were also verified with accurate (2') GNSS measurements				
18 of the wells measured were P&A				

API Number	Well #	Well Name	Point Status	Date Drilled	County	Radial delta Derived-RRC (ft)	Direction delta Derived-RRC
4210333710	2	WA Estes 2	Pumpjack/WH	November 14, 1985	Crane	141	SW
4210333765	3	WA Estes 3	Pumpjack/WH	May 24, 1986	Crane	193	NW
4210333782	4	WA Estes 4	Pumpjack/WH	January 13, 1987	Crane	253	NW
4210300781	24W	WA Estes 24	P&A (04/1995)	May 16, 1955	Crane	72	W/SW
4210300785	31	WA Estes 31	Wellhead	May 22, 1957	Crane	137	SW
4210333553	122	WA Estes 122	Wellhead	October 25, 1984	Crane	72	S
4210335074	1	WA Estes 1	P&A (02/2007)	April 5, 2005	Crane	65	SW
4210333668	1	Gulf WA Estes 1	Pumpjack/WH	July 1, 1985	Crane	414	S
4210333799	5	Gulf WA Estes 5	P&A (07/1991)	July 26, 1987	Crane	386	SE
4210306133	19W	WA Estes 19	P&A (08/1990)	January 30, 1955	Crane	53	E/SE
4210300779	10	WA Estes 10	P&A (02/1993)	June 16, 1951	Crane	352	SW
4210300789	11	WA Estes 11	P&A (10/1993)	April 25, 1952	Crane	236	SW
4210300780	21	WA Estes 21	P&A (10/2010)	April 11, 1955	Crane	234	SW
4210300782	25	WA Estes 25	Pumpjack/WH	June 15, 1955	Crane	217	SW
4210300783	26	WA Estes 26	P&A (03/2020)	July 11, 1955	Crane	279	W/SW
4210331890	105	WA Estes 105	P&A (10/2003)	September 20, 1978	Crane	153	SW
4210332064	107	WA Estes 107	P&A (11/2011)	June 23, 1979	Crane	89	S
4210333552	125	WA Estes 125	P&A (09/1994)	October 7, 1984	Crane	203	SW
4210331883	1W	WA Estes 1	P&A (12/1992)	August 18, 1978	Crane	137	NW
4210300774	5W	WA Estes 5H	P&A (10/1999)	March 6, 1949	Crane	430	W/NW
4210300777	7W	WA Estes 7	P&A (10/1993)	January 11, 1950	Crane	289	W
4210300778	9	WA Estes 9	P&A (03/2020)	December 4, 1950	Crane	334	SW
4210300790	16	WA Estes 16	P&A (03/2020)	January 2, 1954	Crane	377	W
4210300791	20	WA Estes 20	P&A (01/2021)	March 16, 1955	Crane	248	W
4210300784	28W	WA Estes 28	P&A (11/1999)	December 26, 1955	Crane	87	W
4210310321	74	WA Estes 74	P&A (08/1981)	April 14, 1964	Crane	234	W
4210331516	99	WA Estes 99	P&A (09/2002)	June 30, 1977	Crane	170	NW
4210331776	100	WA Estes 100	P&A (10/2003)	November 15, 1977	Crane	286	SW
4210331906	106	WA Estes 106	Pumpjack/WH	August 1, 1978	Crane	418	W/SW
4210332865	112	WA Estes 112	Pumpjack/WH	March 14, 1982	Crane	61	SW
4210333535	121	WA Estes 121	P&A (01/1999)	October 16, 1984	Crane	675	W
4210334104	124	WA Estes 124	Pumpjack/WH	November 13, 1990	Crane	241	W
4210335537	126	WA Estes 126	Pumpjack/WH	March 15, 2008	Crane	209	SW
4210335535	127	WA Estes 127	Pumpjack/WH	March 23, 2008	Crane	216	SW
4210335539	130	WA Estes 130	Pumpjack/WH	April 25, 2008	Crane	210	SW
4210335234	1	WA Estes "2" 1	Not drilled	March 17, 2006	Crane	0	N/A
4210300772	1H	WA Estes 1H	Pumpjack/WH	October 30, 1942	Crane	328	SW
4210381153	3H	WA Estes 3H	P&A (01/1973)	June 21, 1944	Crane	163	SW
4210300776	6H	WA Estes 6H	P&A (09/1994)	August 17, 1949	Crane	136	NW
4210335536	128	WA Estes 128	Pumpjack/WH	April 30, 2008	Crane	219	SW
4210335538	129	WA Estes 129	Pumpjack/WH	April 2, 2008	Crane	222	SW
NO API #	Unknown	Topo well - East	P&A (Unknown)	Unknown	Crane		Not in RRC
NO API #	Unknown	Topo well - West	P&A (Unknown)	Unknown	Crane		Not in RRC
4210300773	4H	WA Estes 4H	P&A (01/1973)	June 23, 1945	Crane	187	
4210305224	87, 7-31	WA Estes 87W	P&A (01/1997)	May 8, 1954	Crane	319	SW
4210305151	88, 7-41	WA Estes 88	P&A (06/2008)	October 15, 1958	Crane	243	SW
4210303889	89, 7-42	WA Estes 89W	P&A (12/1992)	February 22, 1959	Crane	174	W

NO API #	2	WA Estes 2	P&A (02/1953)	January 10, 1944	Crane	97	S
4210304770	1, 101	WA Estes 101	Pumpjack/WH	August 3, 1958	Crane	36	W
4210304771	2, 102	WA Estes 102	Pumpjack/WH	October 7, 1958	Crane	191	W
4210304772	3, 103	WA Estes 103	P&A (01/2019)	October 21, 1958	Crane	45	SW
4210304773	4, 104W	WA Estes 104W	P&A (12/1992)	November 20, 1958	Crane	102	N
4210332261	108	WA Estes 108	Pumpjack/WH	May 1, 1980	Crane	62	W
4210332445	109	WA Estes 109	Pumpjack/WH	December 28, 1980	Crane	76	NW
4210332543	111	WA Estes 111	P&A (01/2000)	April 24, 1981	Crane	61	NE
4210332928	115	WA Estes 115	P&A (11/2011)	May 23, 1982	Crane	75	SW
NO API #	Unknown	Topo oil well	P&A (Unknown)	Unknown	Crane		Not in RRC
NO API #	CT-105	CT-105	P&A (05/1958)	May 3, 1958	Crane		Not in RRC
NO API #	CT-106	CT-106	P&A (05/1958)	May 12, 1958	Crane		Not in RRC
NO API #	ST-107	ST-107	P&A (12/1960)	October 3, 1960	Crane		Not in RRC
4210335371	1	Estes 13 #1	Wellhead	April 11, 2007	Crane	0	S
4210335530	2	Estes 13 #2	Wellhead	January 29, 2008	Crane	103	NE
4210332770	114	WA Estes 114	Wellhead	January 26, 1982	Crane	117	NE
4247534738	1	WA Estes 1	Pumpjack/WH	January 19, 2002	Ward	50	SW
4247534784	2	WA Estes 2	Pumpjack/WH	June 1, 2003	Ward	58	SW
4247510100	68	WA Estes 68	Pumpjack/WH	September 18, 1963	Ward	180	SW
4247510102	70	WA Estes 70	P&A (02/1989)	December 20, 1963	Ward	404	SW
4247530448	91	WA Estes 91	Wellhead	February 4, 1972	Ward	642	SW
4247501241	8	WA Estes 8H	P&A (08/1995)	June 8, 1950	Ward	495	SW
4247501249	23	WA Estes 23W	P&A (11/1999)	August 4, 1955	Ward	488	SW
4247501250	27	WA Estes 27W	P&A (11/1999)	September 2, 1955	Ward	167	SW
4247501275	55	WA Estes 55W	P&A (11/1999)	May 27, 1960	Ward	231	SW
4247501276	56, 56-D	WA Estes 56	P&A (09/1997)	January 24, 1961	Ward	172	SW
4247533434	120	WA Estes 120	Pumpjack/WH	July 24, 1984	Ward	517	W
4247534037	123	WA Estes 123	P&A (12/2011)	November 2, 1990	Ward	197	SW

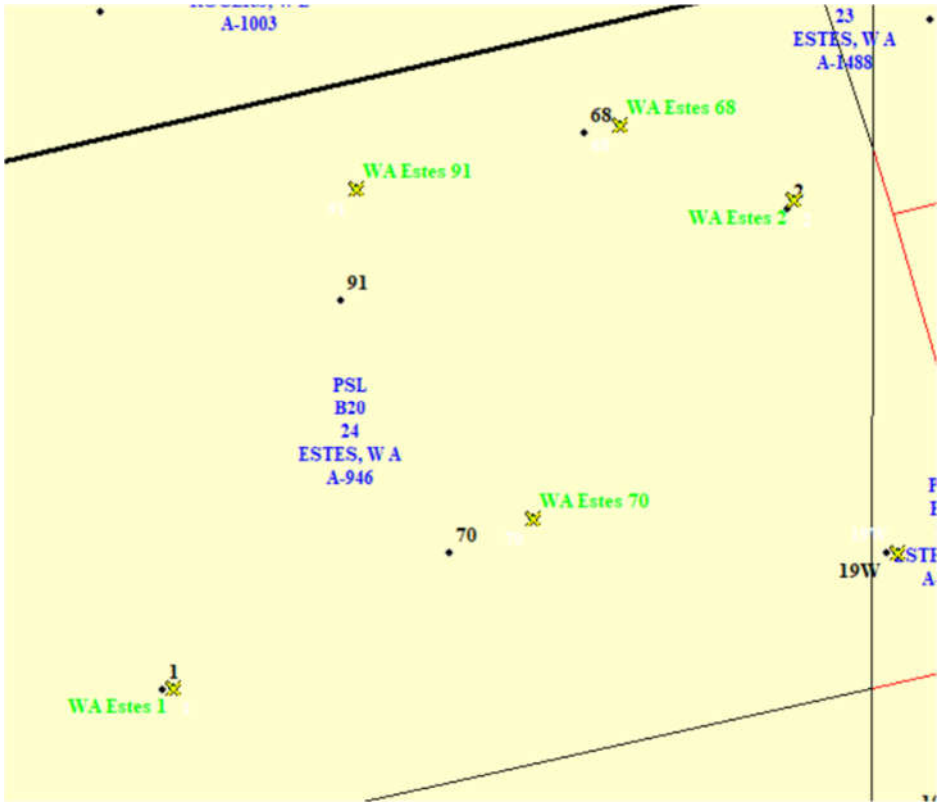
Snapshots of well locations – Antina Ranch study area

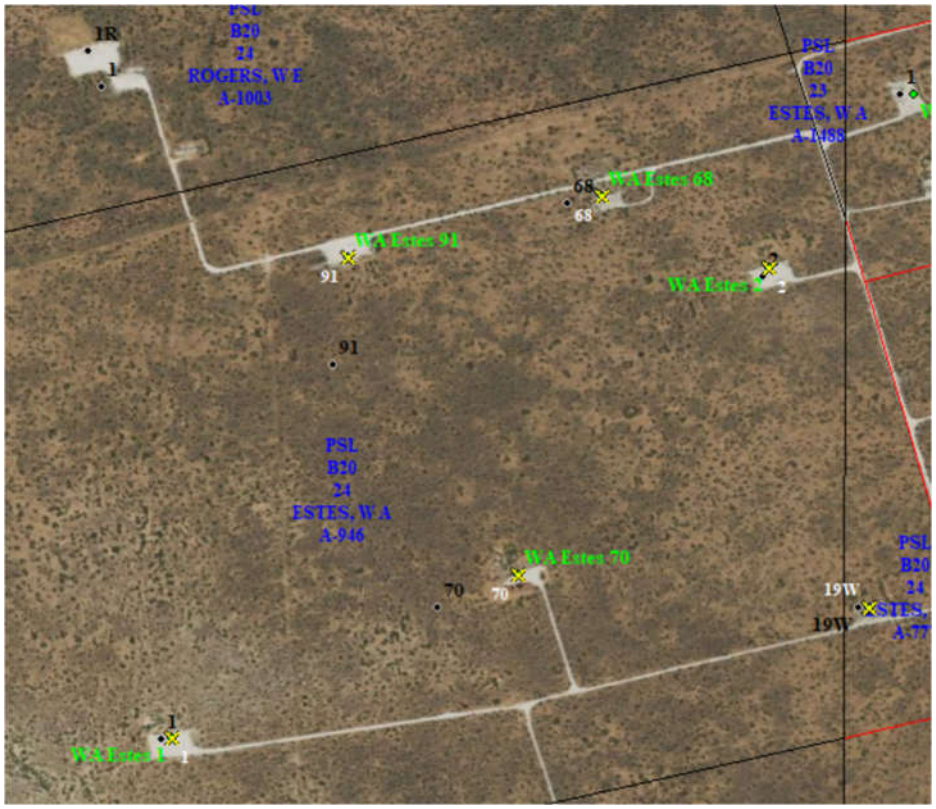
- One with no background
- One with NAIP imagery background

Labelling

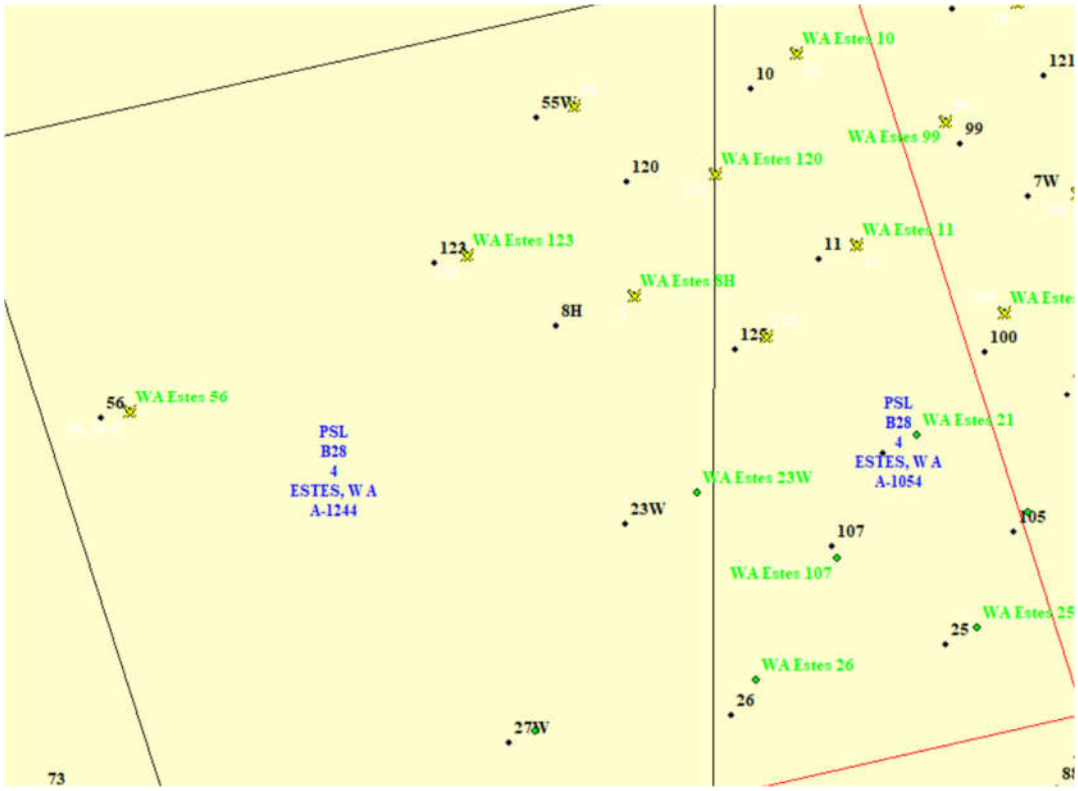
- Black dot/label- RRC GIS location
- green/blue-dot/label- Final derived location
- Yellow X/white label- GNSS location (31 wells

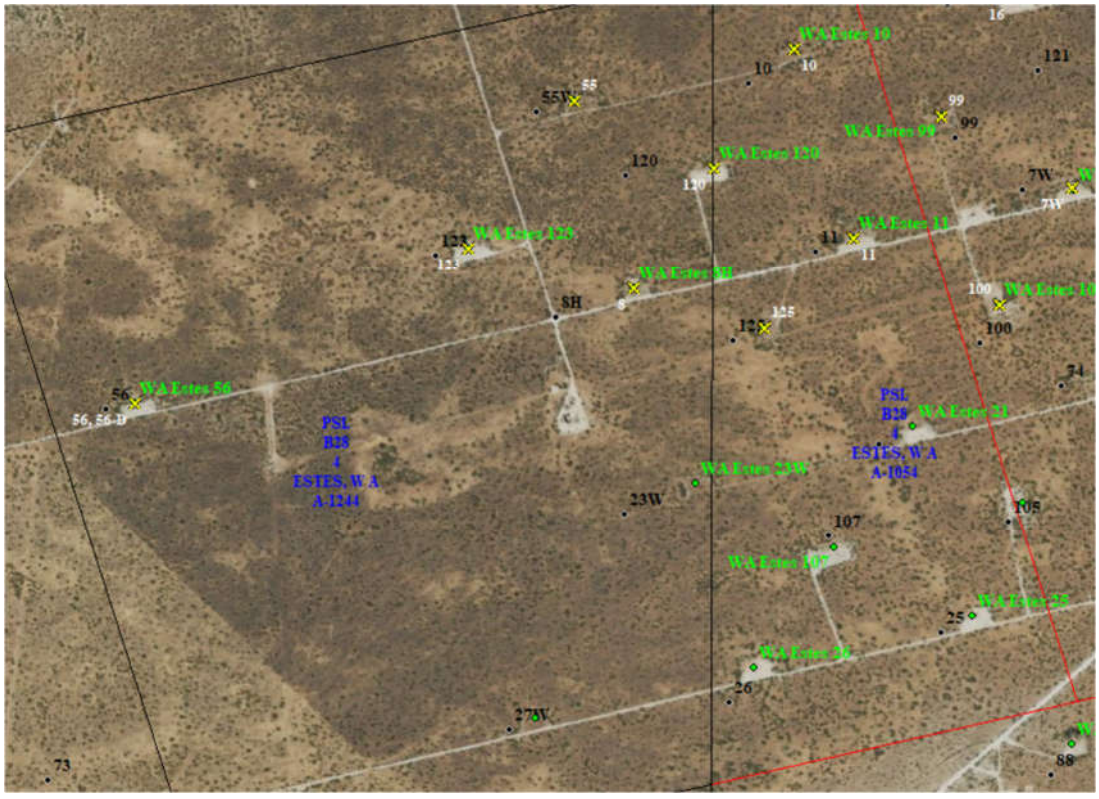
Section 24 Ward County



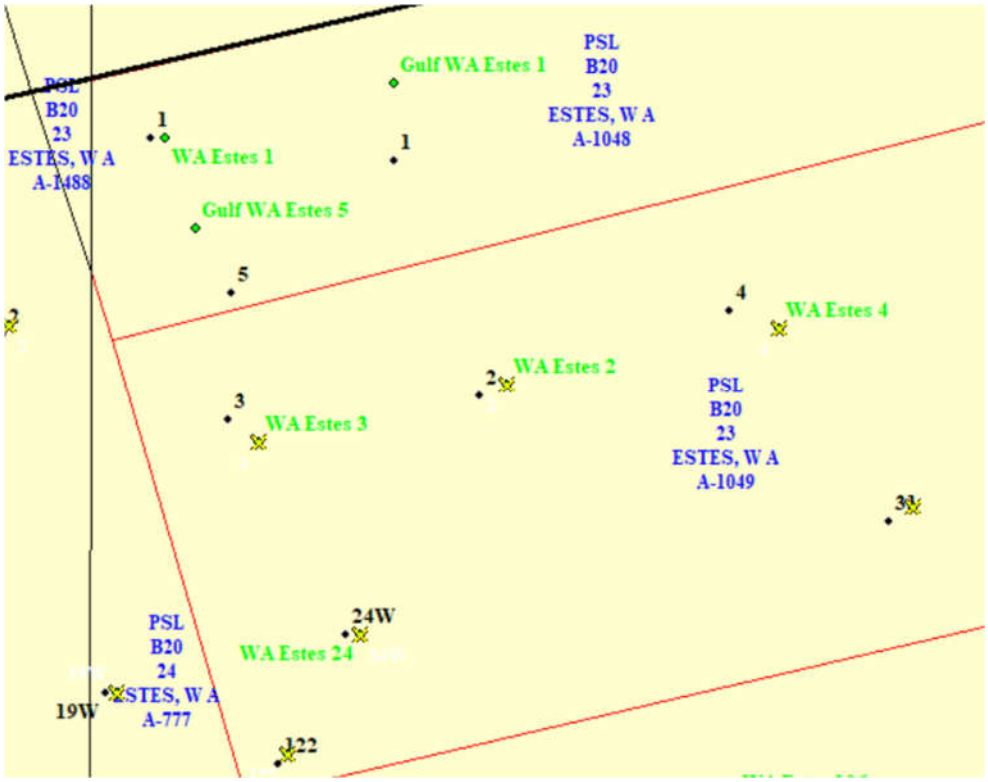


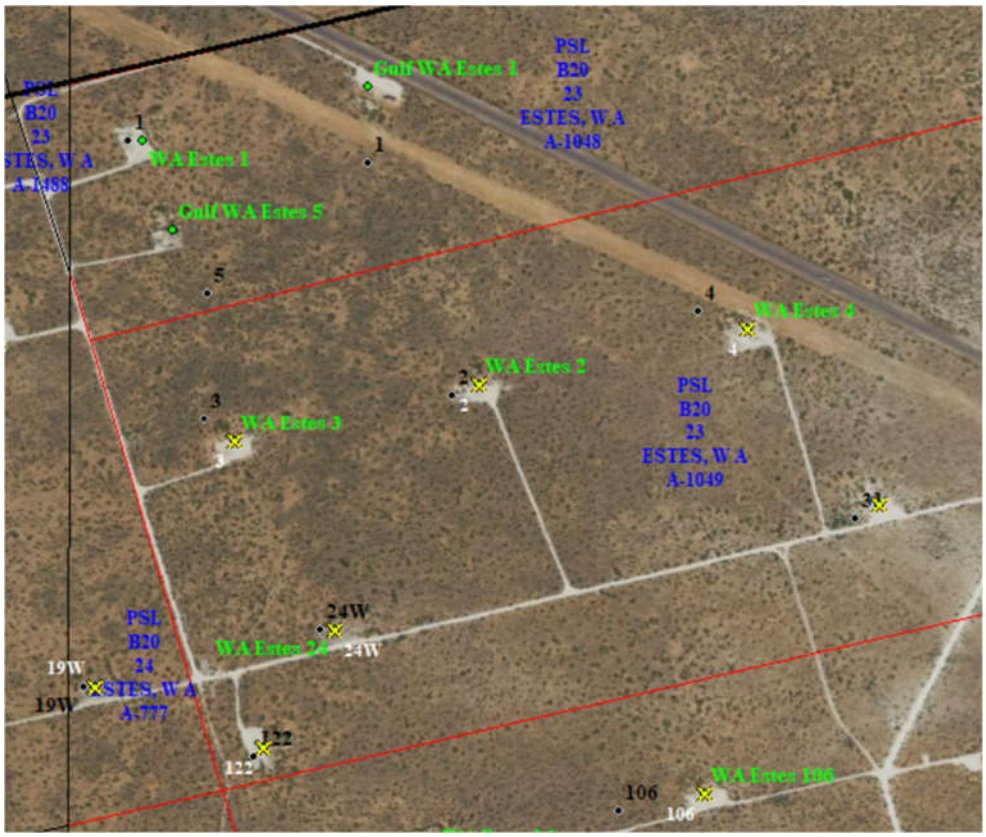
Section 4 Ward County, Section 4 Crane County



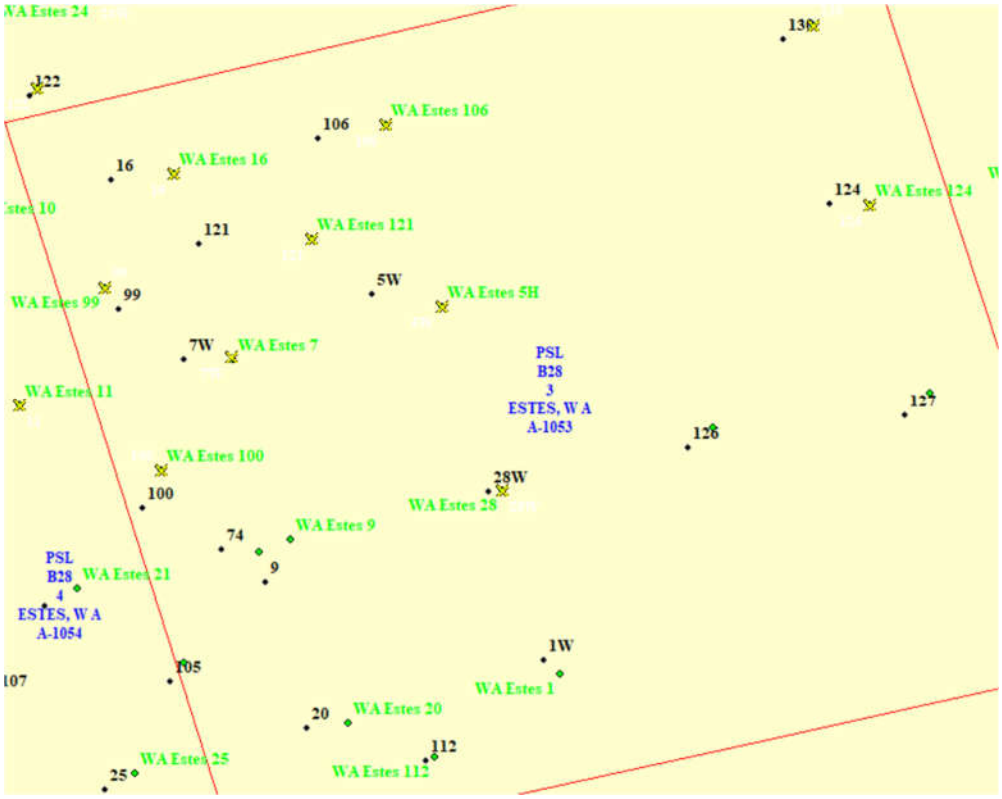


Section 23 & 24 Crane County

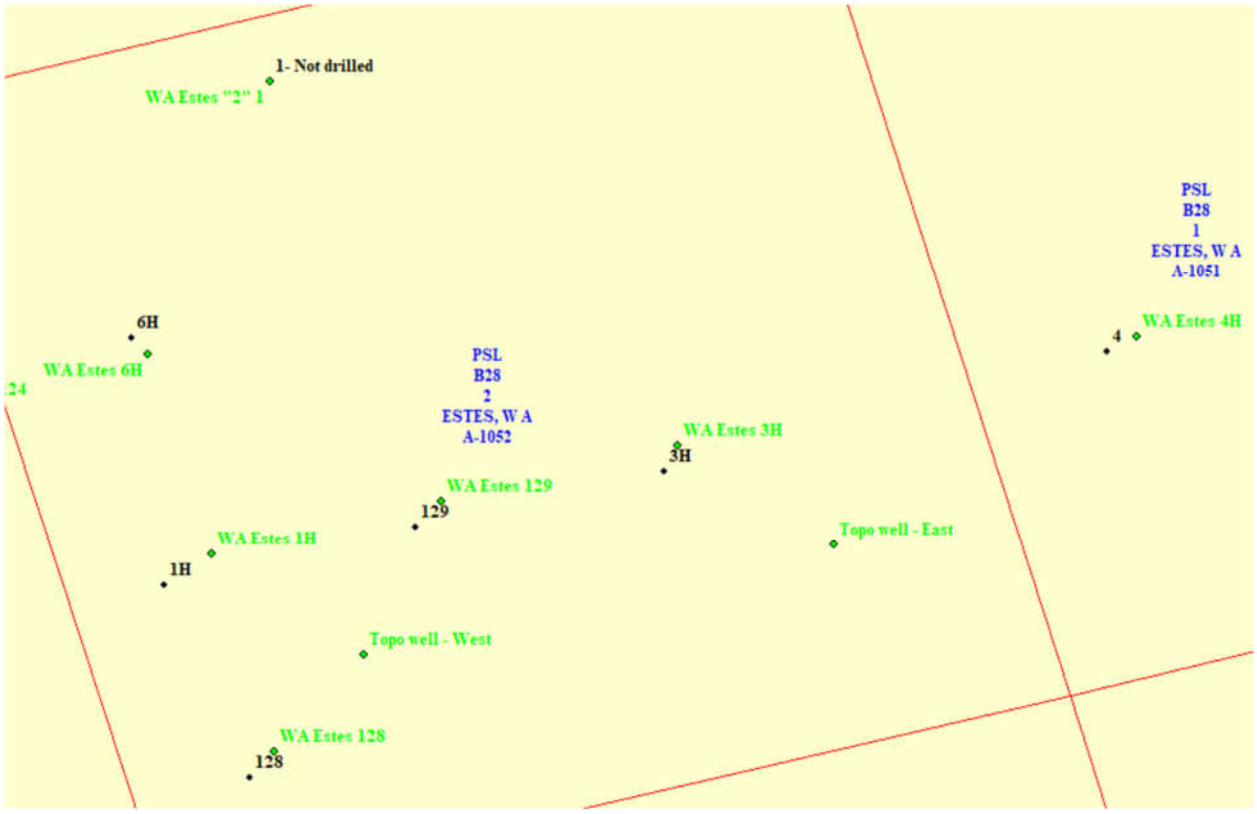


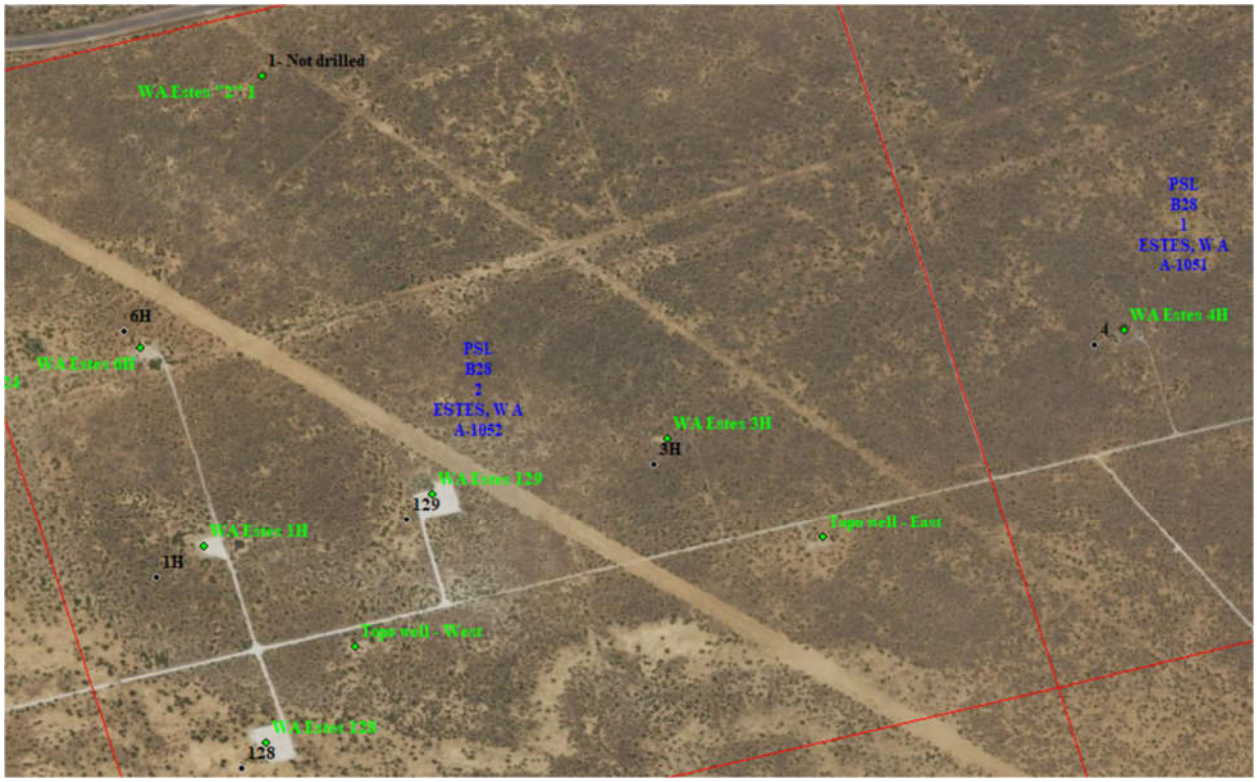


Section 3 Crane County

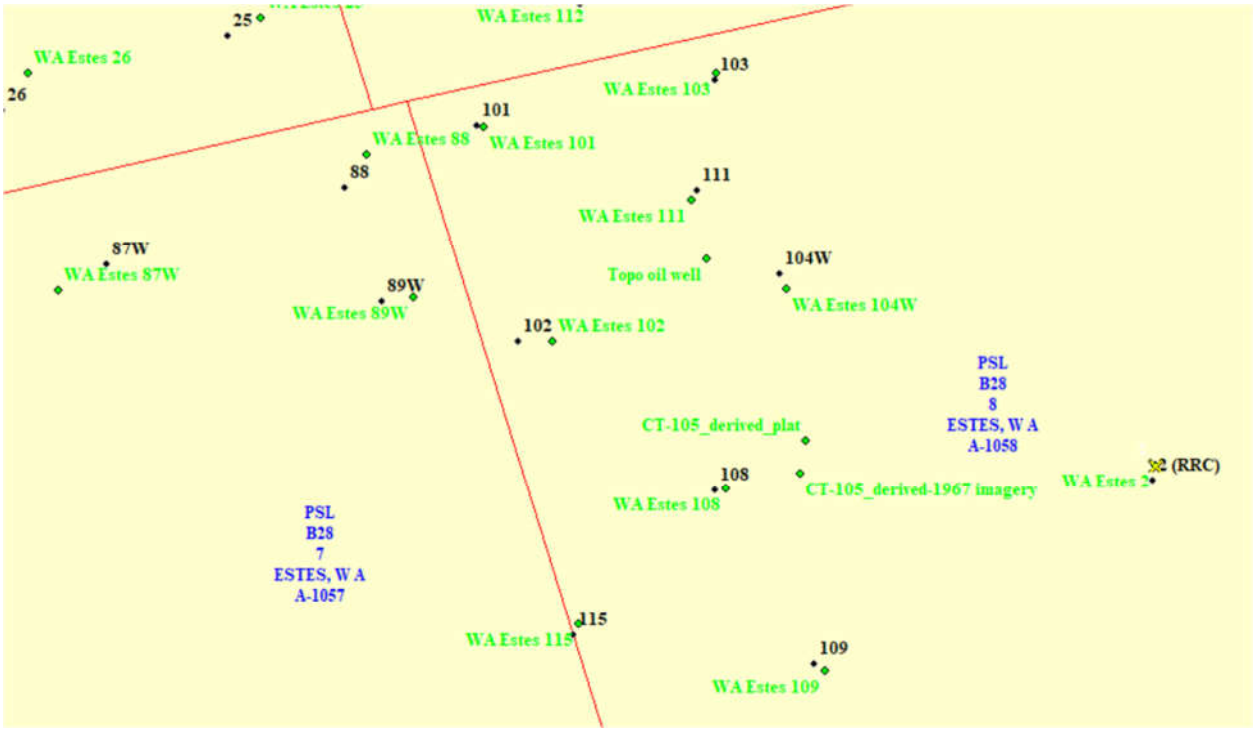


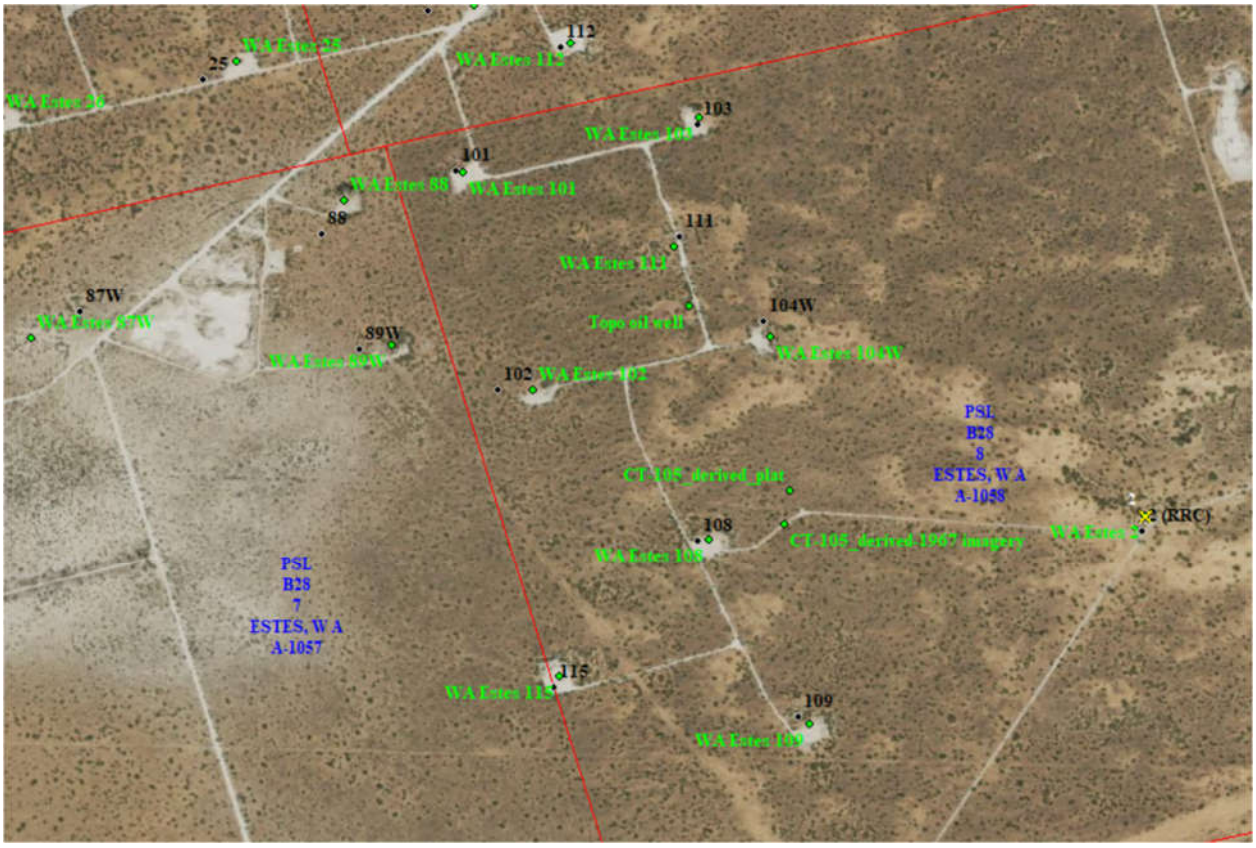
Section 1 & 2 Crane County



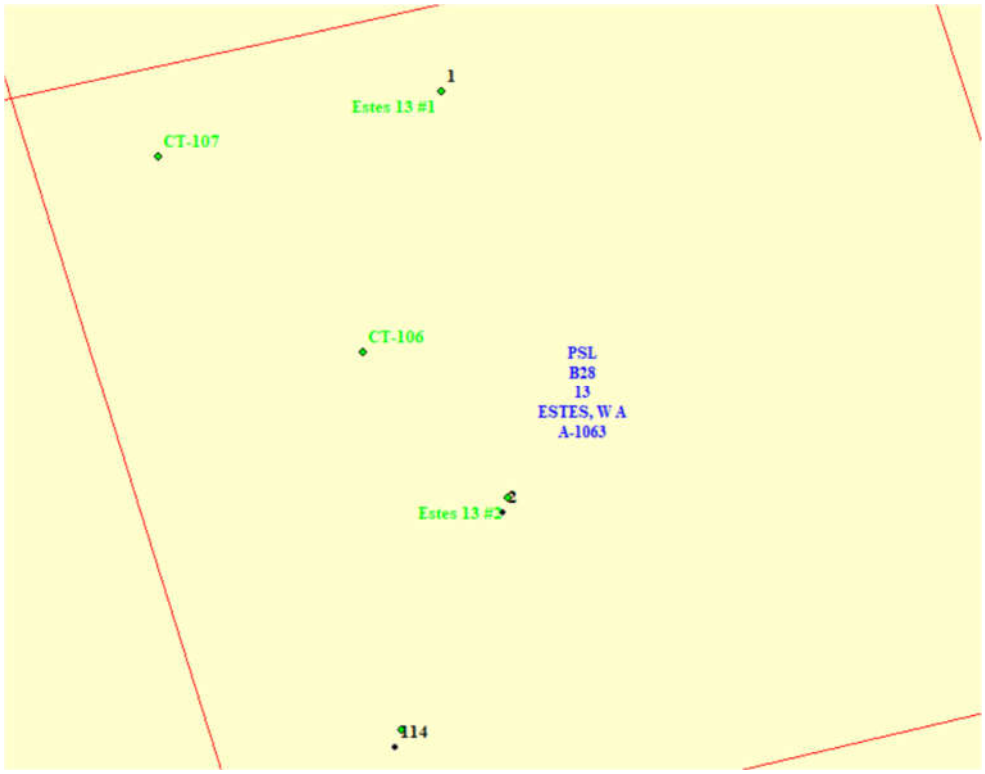


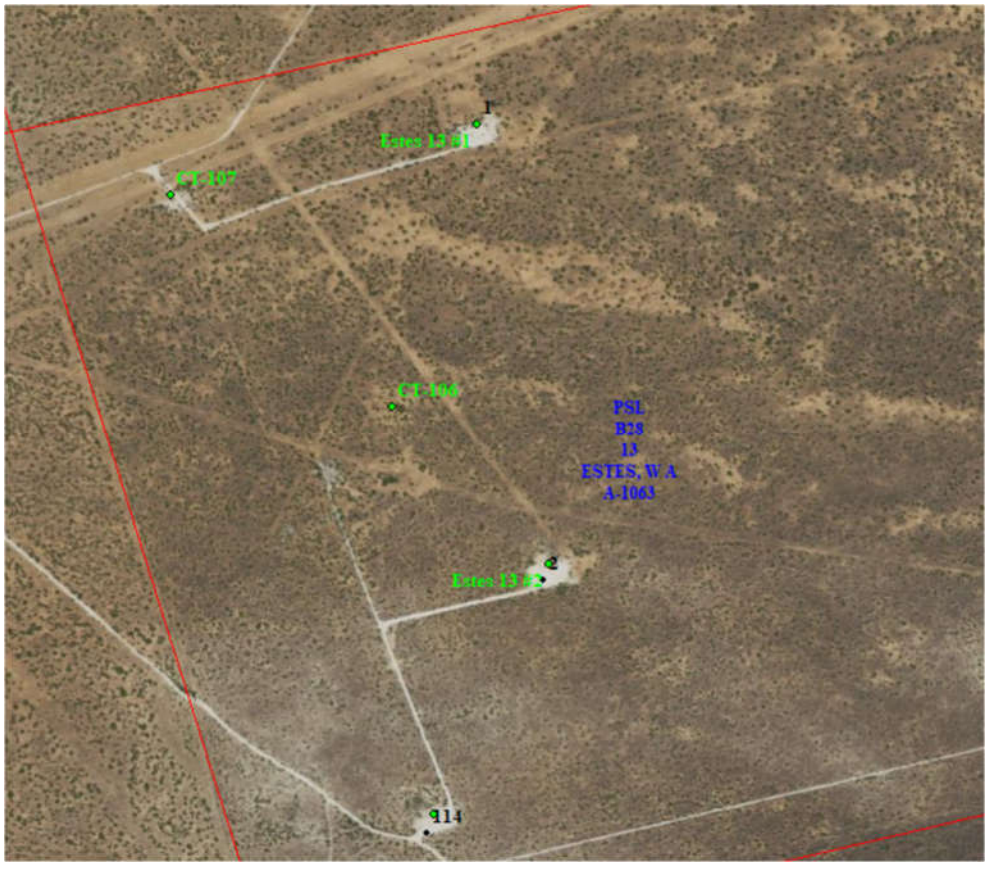
Section 7 & 8 Crane County



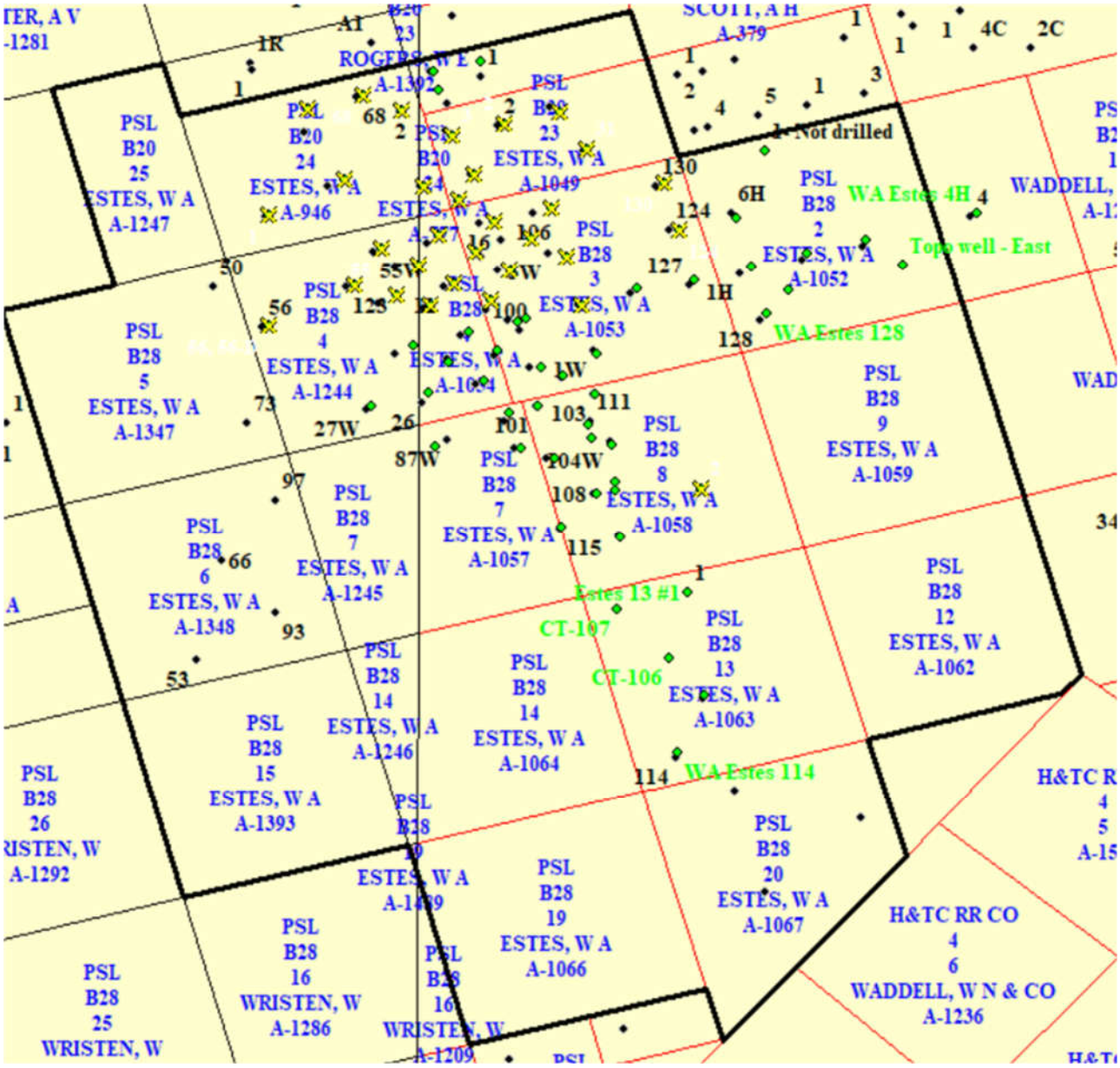


Section 13 Crane County





All sections



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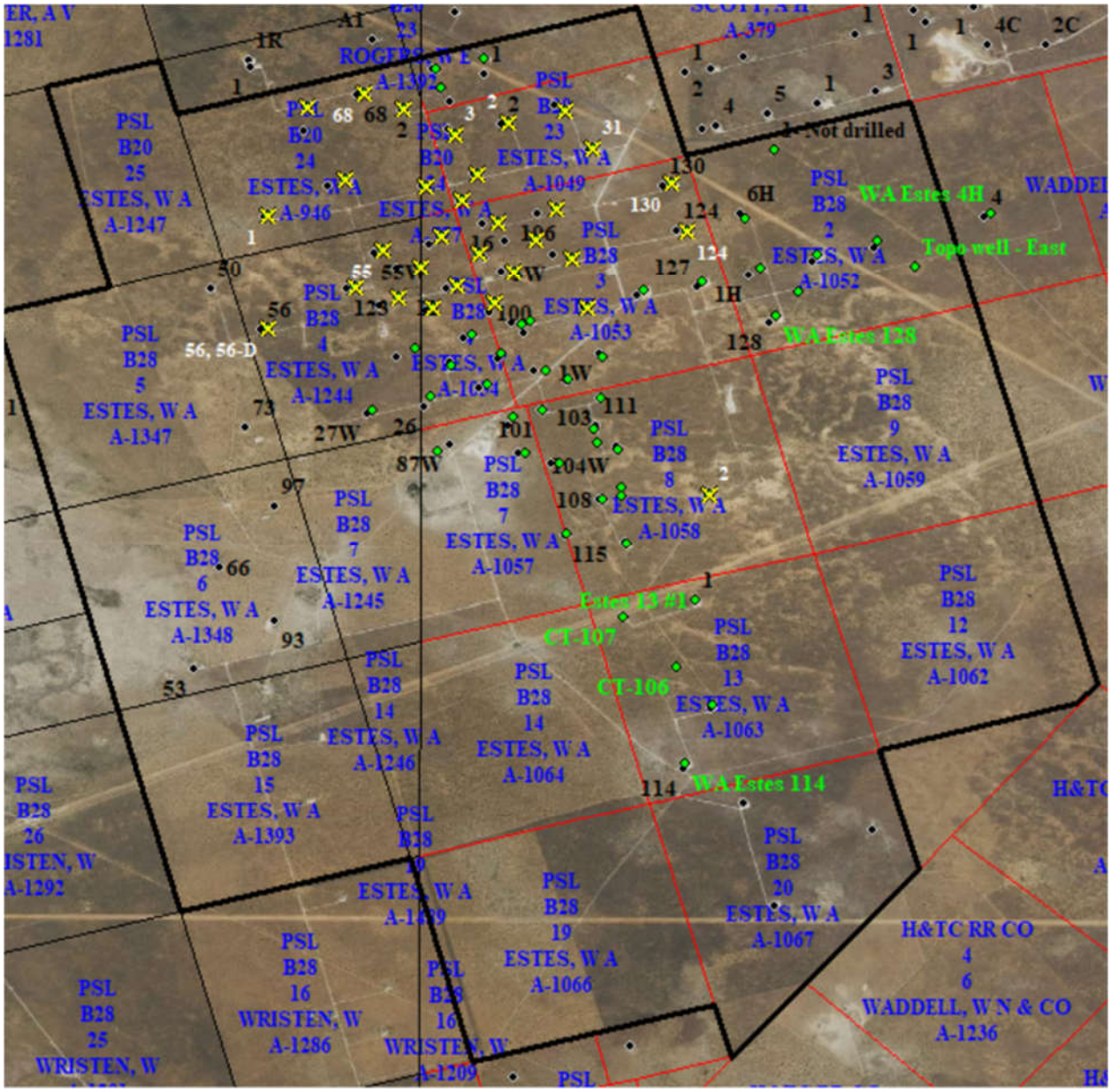

Photos of GNSS measured wells

P & A wells with water monitor post

1) W A Estes 24 (GNSS at water monitor post)

2) W A Estes 28 (iron P&A sign post in background) GNSS at water monitor post

3) W A Estes 16 (GNSS at water monitor post)

P & A wells with sign post

1) W A Estes 5/5H/5W

2) W A Estes 11

3) W A Estes 55/55W

P & A wells with no evidence of wellbore

1) W A Estes 7W

2) W A Estes 99

3) W A Estes 123

Wells with evidence

1) W A Estes 31

2) W A Estes 68

3) W A Estes 122

Conclusions and Recommendations

Our conclusions mirror those included in the initial G-Forensic case study. Existing public well databases misrepresent well geo-locations. As time progresses and surface visibility indicators diminish, finding P&A wells becomes more difficult and risks become greater. Our work defining seventy-five wells on the Antina Ranch involved hundreds of man hours. The average location difference of the wells in the study as compared to where the Railroad Commission has the wells located is over *200' and range from 36' to 675'.*

Sadly, the results of our work, including the improvement in location representations, identification, and supporting documentation, will likely never reach beyond this case study and the team at Ashley Watt's Ranch.

There is an obvious solution to the geo-location misrepresentation issue; but it involves the realization and recognition by stakeholders that determining and documenting the proper results have value, that recording and maintaining those results are beneficial to future work, and that those results impact our collective understanding of the risks posed by historical wells to life, property and the environment.

This study fully validates our understanding of the lack of knowledge relating to well geo-location. It may also highlight why impacted stakeholders continue to ignore their responsibilities toward accurately locating and representing the risks posed by oil and gas wells. It is hoped through the documentation and presentation of our detailed effort that eventually those organizations who have the resources, concern, and sense of responsibility will take steps to progressively address and resolve the issues.

The recommendations of the G-Forensic team are clearly stated in our initial study and the complied addendum. This case study and those that are to follow to address additional areas and ranches, should provide the necessary documentation to cause readers to consciously think about proactive versus reactive efforts. Sarah Stogner, a candidate for the Railroad Commission in 2022 and an advocate for necessary changes defined the reactive efforts of orphan wells calling it ***Whack-a-Mole*** after the kids' game of dealing with what pops up. Sadly, the P&A wells of today will become the **"Moles"** of the future and the risks will be greater if the corrupted location data is not addressed or the realization that many well locations are not even identified at all.