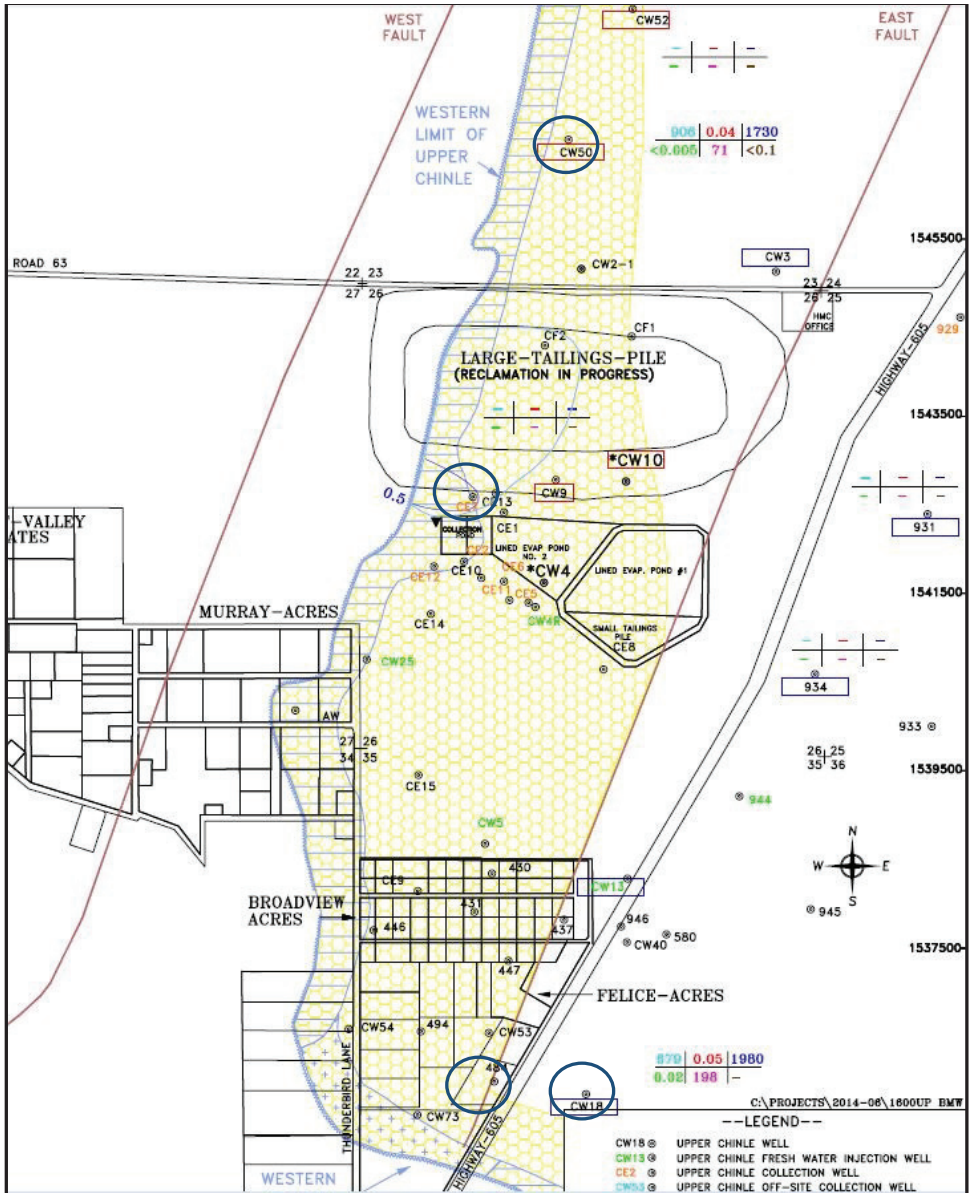
BACKGROUND INVESTIGTION
UPPER AND MIDDLE CHINLE AQUIFERS

HOMESTAKE NPL SITE

DRAFT – FOR DISCUSSION PURPOSES ONLY

9787559

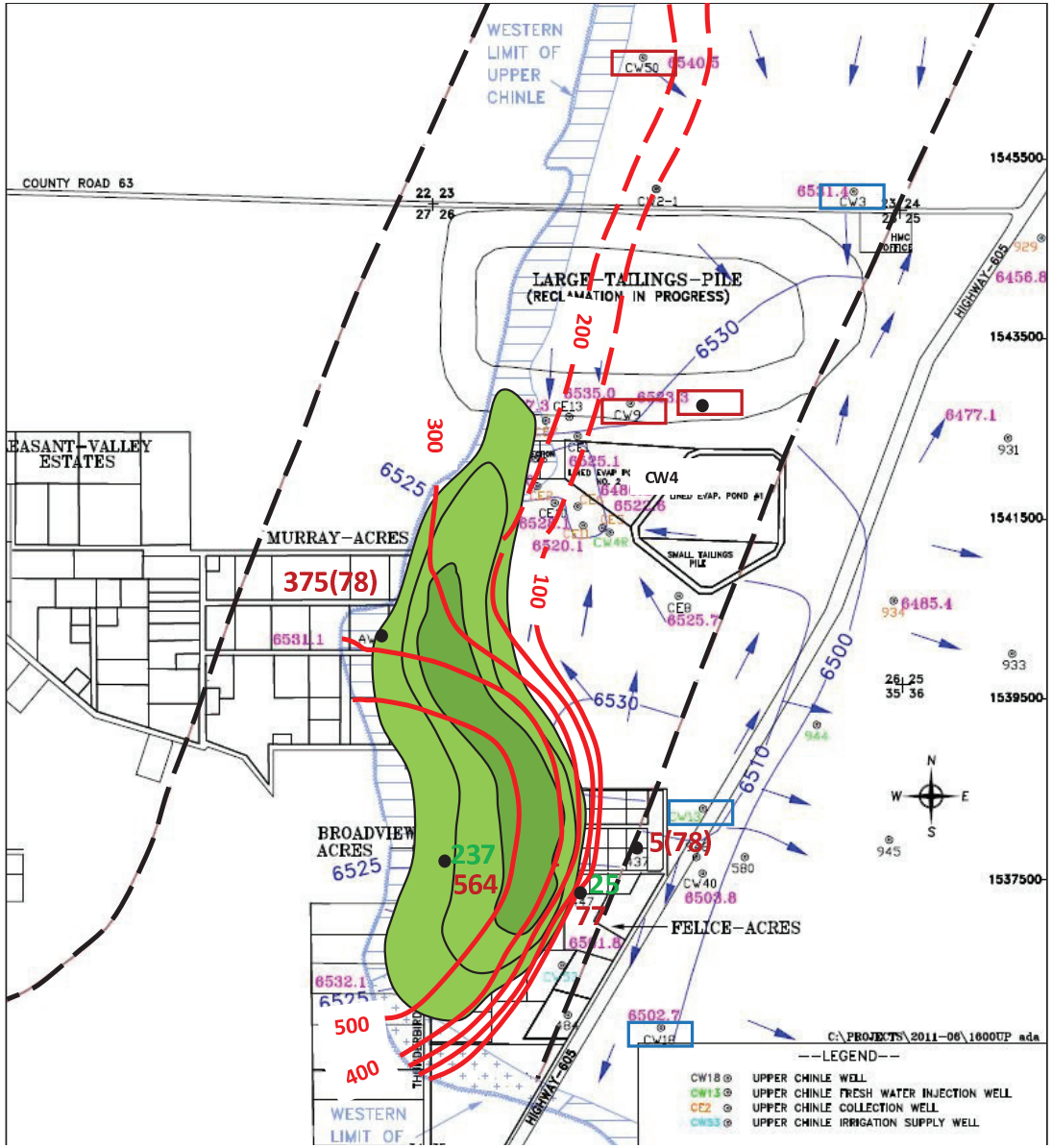


UPPER CHINLE MIXING ZONE AND BACKGROUND WELL LOCATION

HMC 2013 ANNUAL REPORT

Well to consider for additional testing

DRAFT – FOR DISCUSSION PURPOSES ONLY



CALCIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle Aquifer

1976

508 Uranium (ppb)

564 Calcium (ppb)

5(78) Calcium (ppb) - 1978

Uranium >100 ppb

Uranium >250 ppb

Uranium >500 ppb

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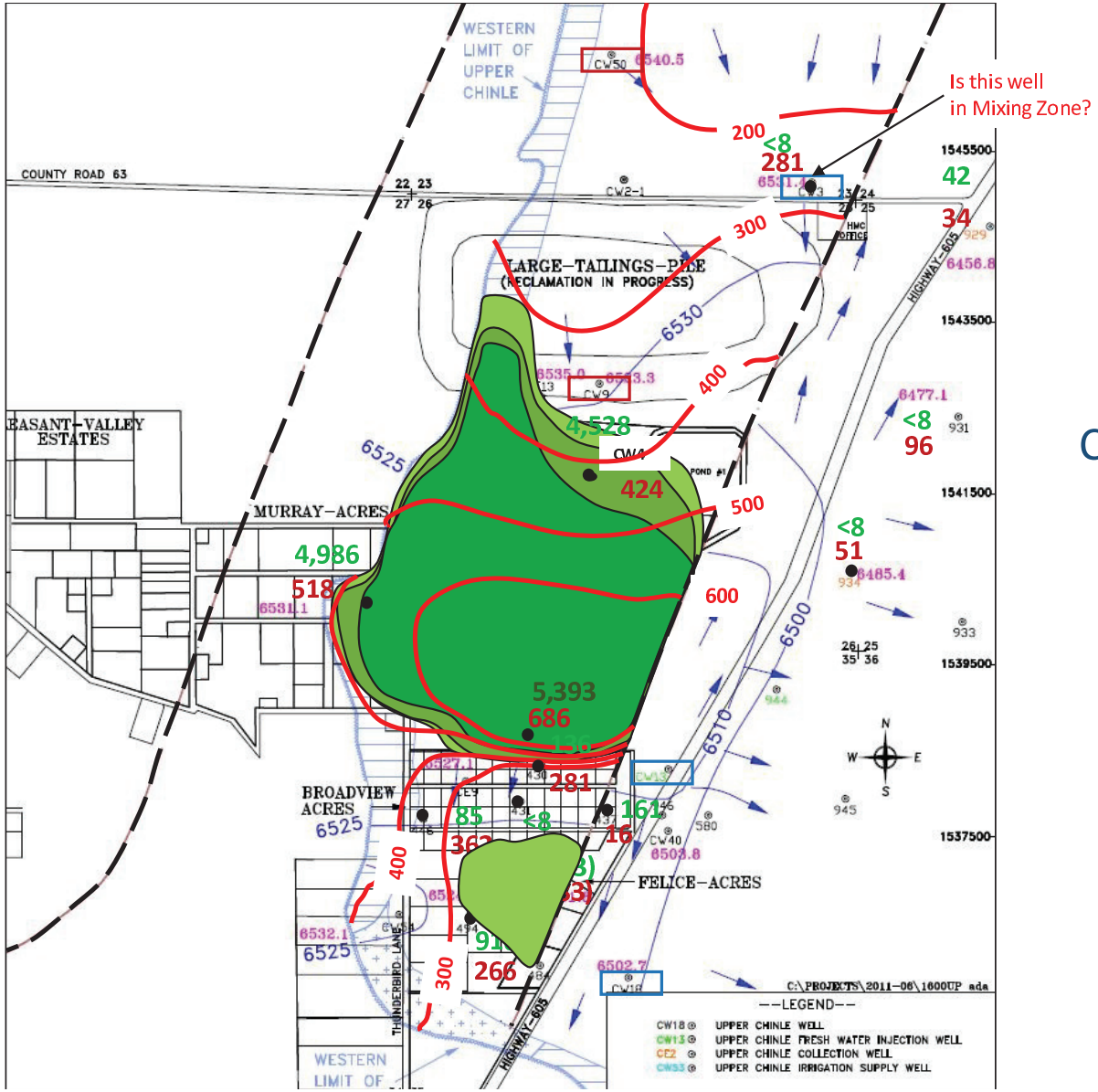
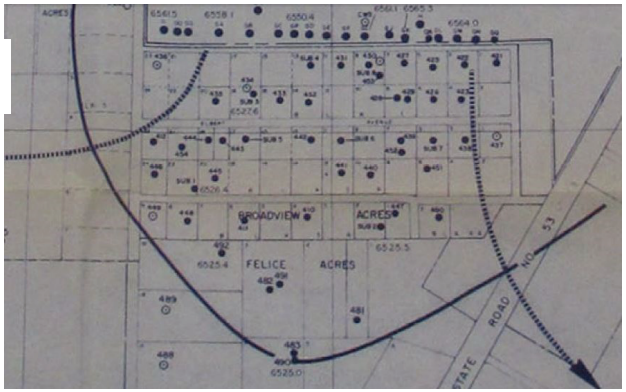




CALCIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle Aquifer

1982-84

508 Uranium (ppb)

564 Calcium (ppb)

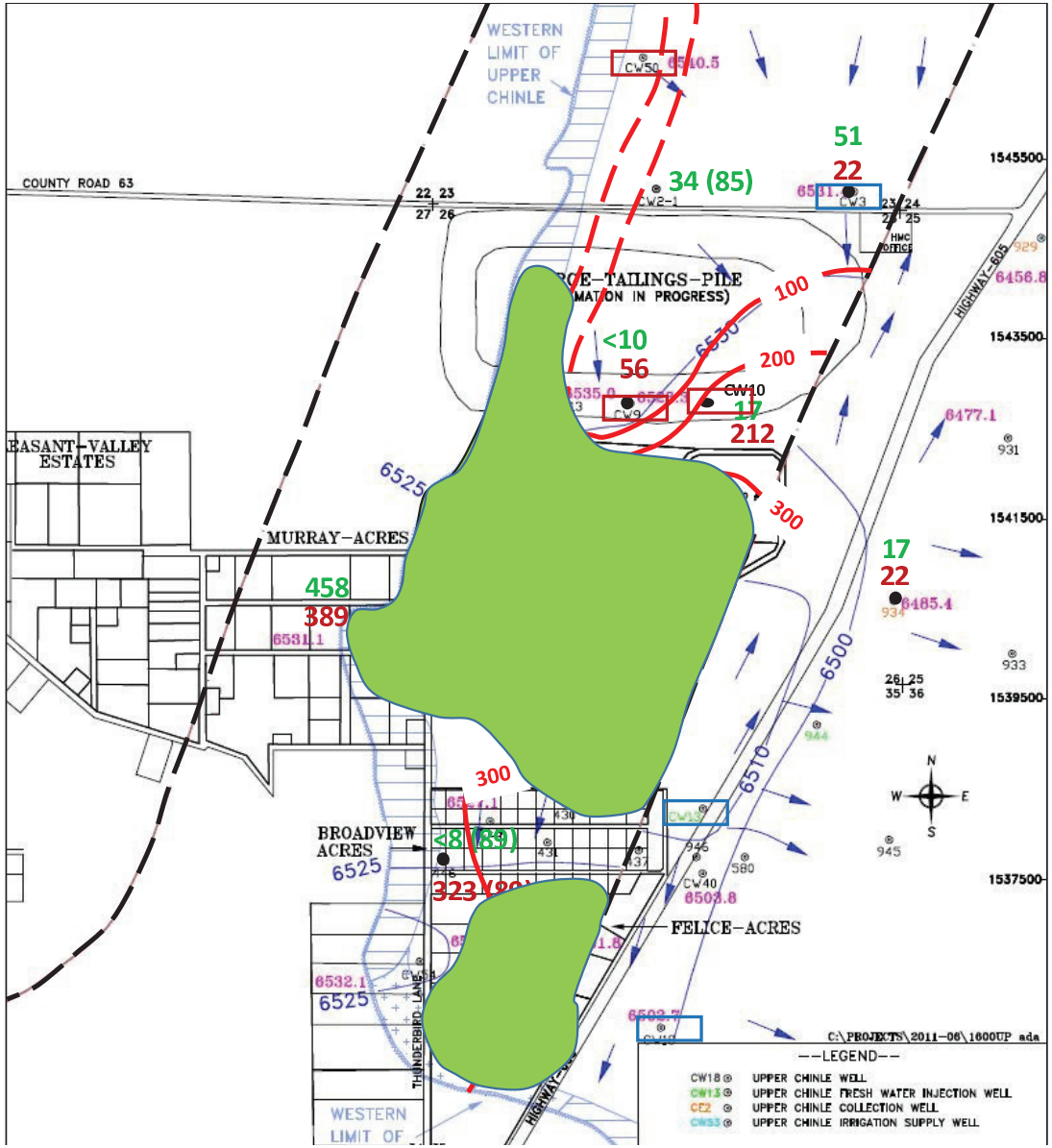
212(83) Calcium (ppb) - 1983

Uranium >1,000 ppb

Uranium >2,500 ppb

Uranium >5,000 ppb

DRAFT – FOR DISCUSSION PURPOSES ONLY



CALCIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle Aquifer

1987

508	Uranium (ppb)
564	Calcium (ppb)
5(78)	Calcium (ppb) - 1978

Uranium >100 ppb

Uranium >500 ppb

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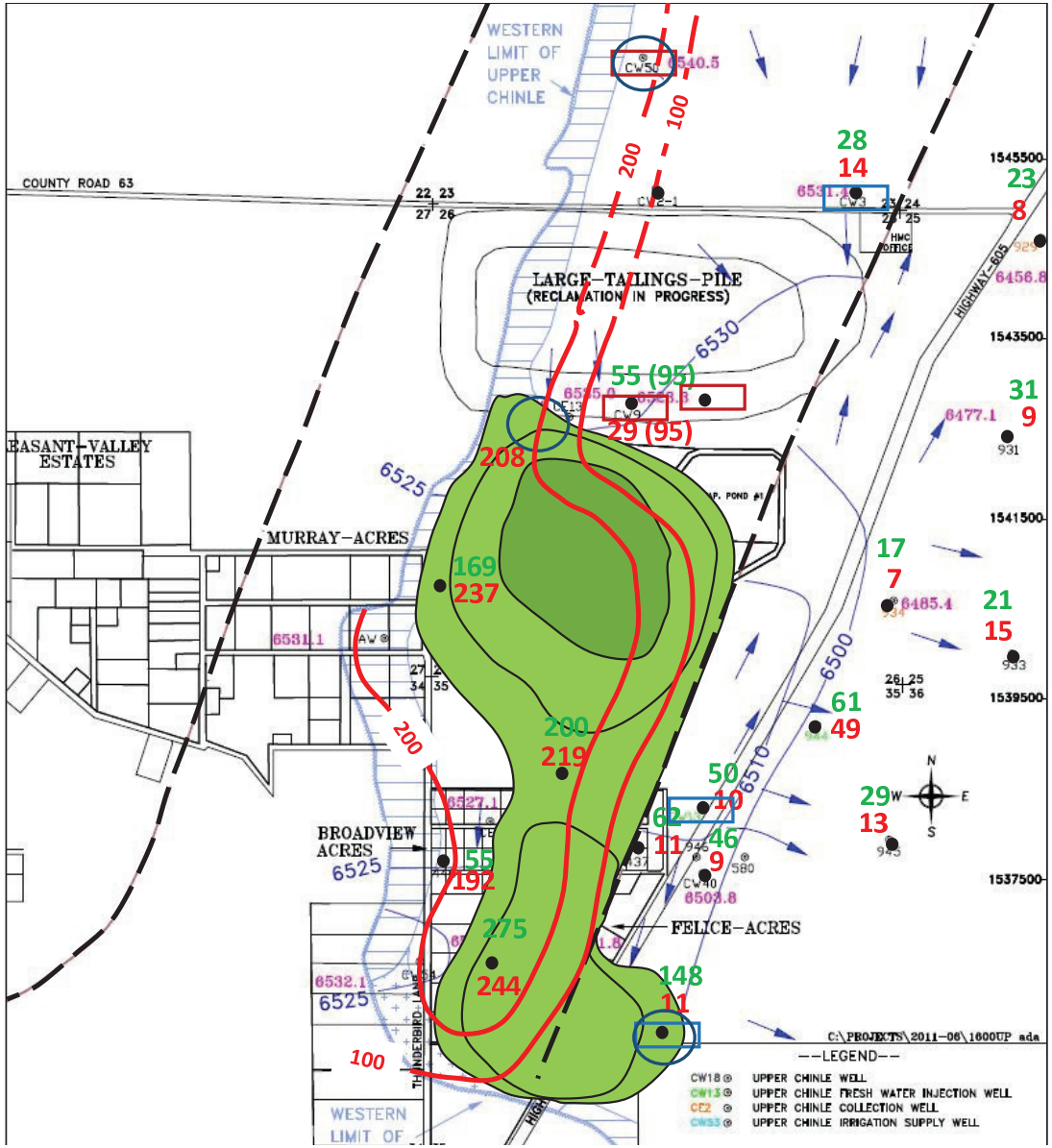


CALCIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle Aquifer

1996

Wells Proposed for Additional Testing

508 Uranium (ppb)

564 Calcium (ppb)

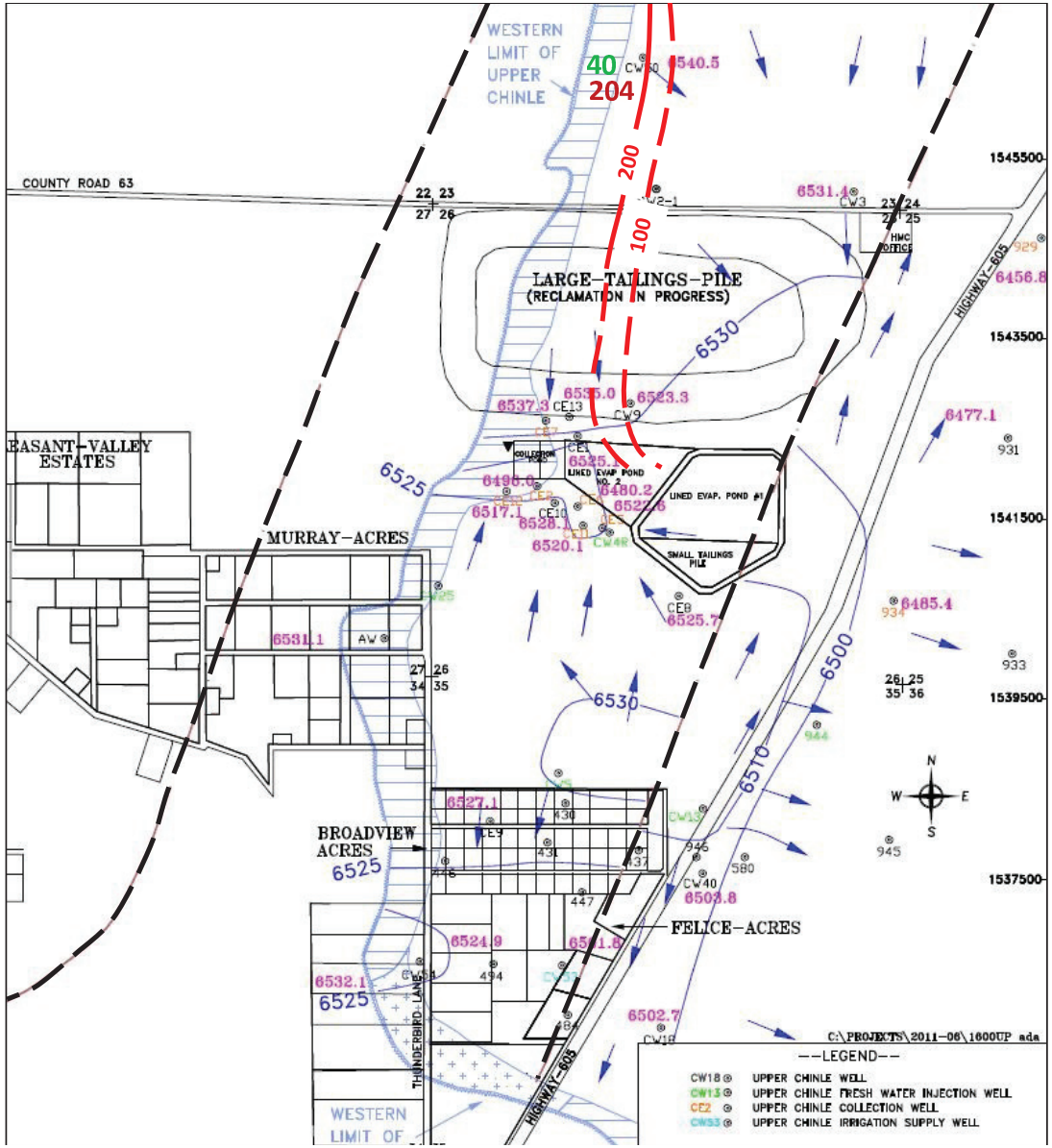
29(95) Calcium (ppb) - 1978

Uranium >100 ppb

Uranium >250 ppb

Uranium >500 ppb

DRAFT – FOR DISCUSSION PURPOSES ONLY



CALCIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle Aquifer

2014

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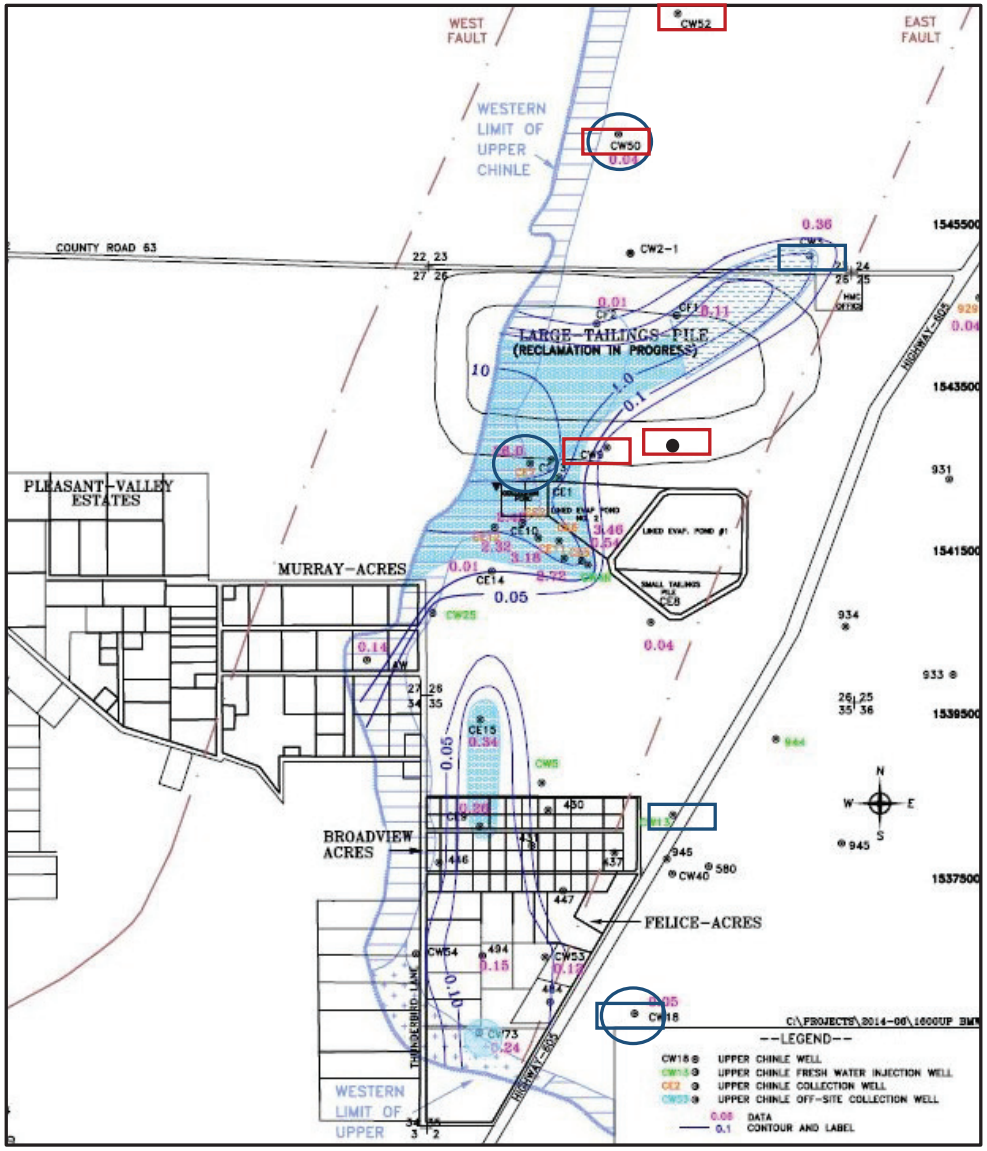
URANIUM ISOCONCENTRATION CONTOUR MAP

Upper Chinle

Homestake 2013 Annual Report

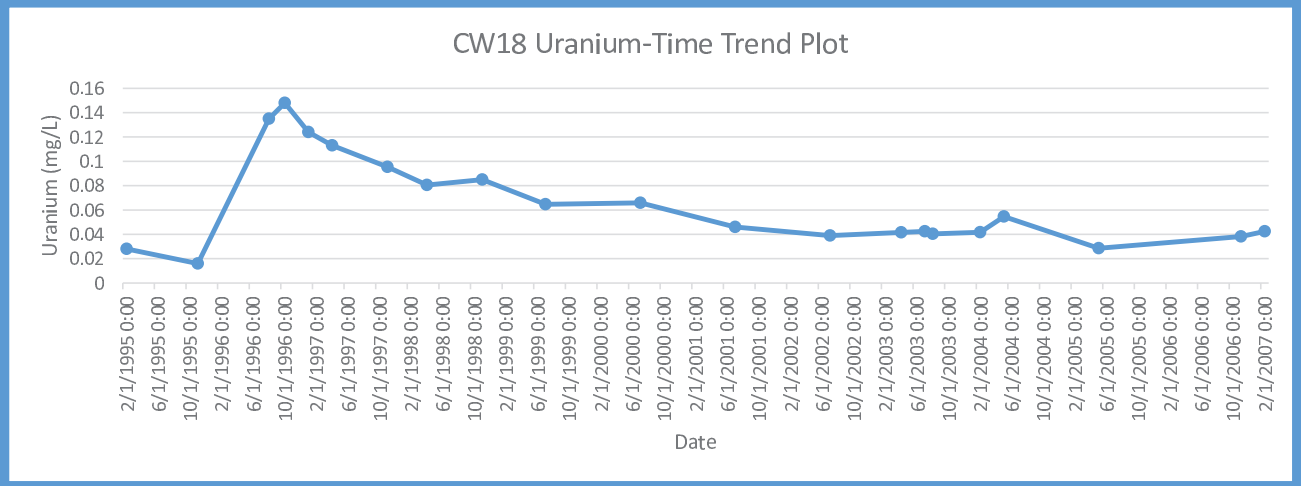
Well to consider for additional testing

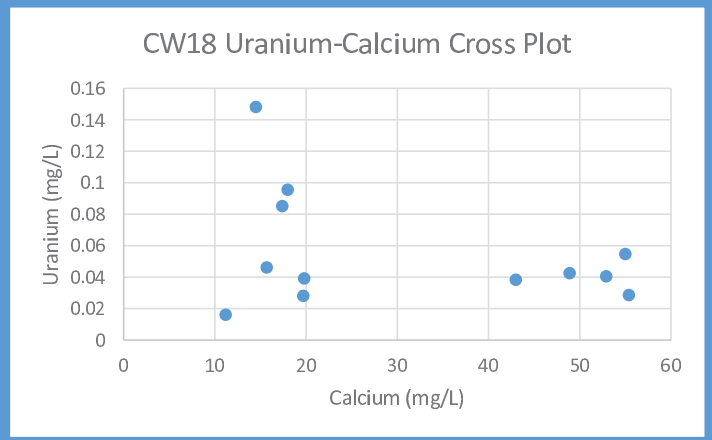


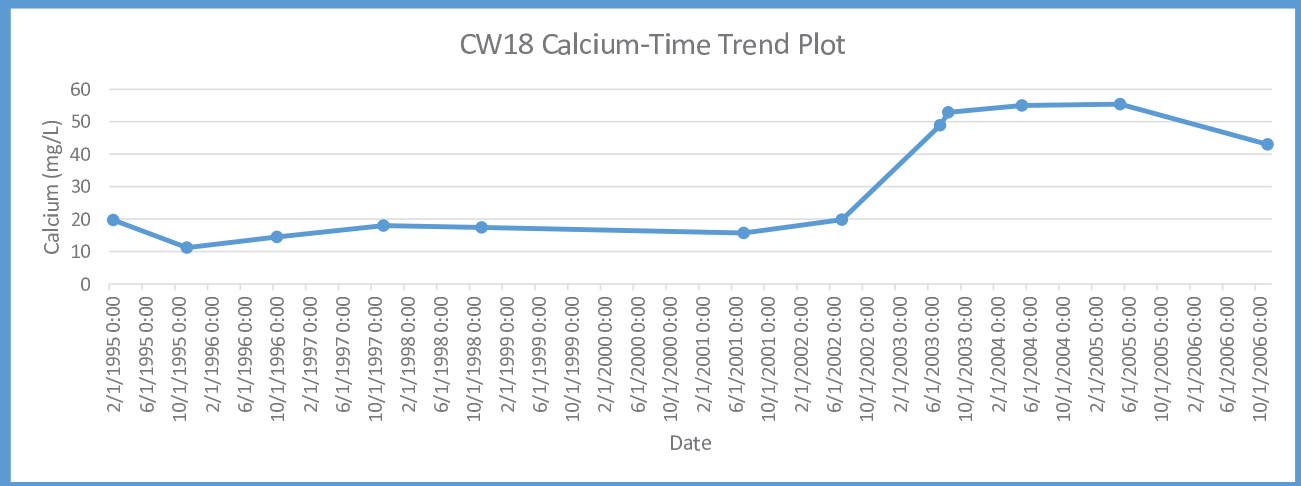
WELLS CONSIDERED FOR ADDITIONAL TESTING UPPER CHINLE

- High Calcium – Low Uranium
  - CW50 – Mixing Zone, Not Impacted?
    - Uranium level increased to about 300 ppb in 2013; possible impact from HMC operations
- High Calcium – High Uranium
  - CE7 – Mixing Zone, Impacted
    - Extraction Well
- Low Calcium – Low Uranium
  - CW18 – Non Mixing Zone, Impacted?
    - Uranium levels increased in 1996; appears to be impacted by HMC Operations
    - Water levels varied over 100 feet between 2003 and 2014; impacted from HMC operations
- Low Calcium – High Uranium

CW18 Uranium and Calcium Trends







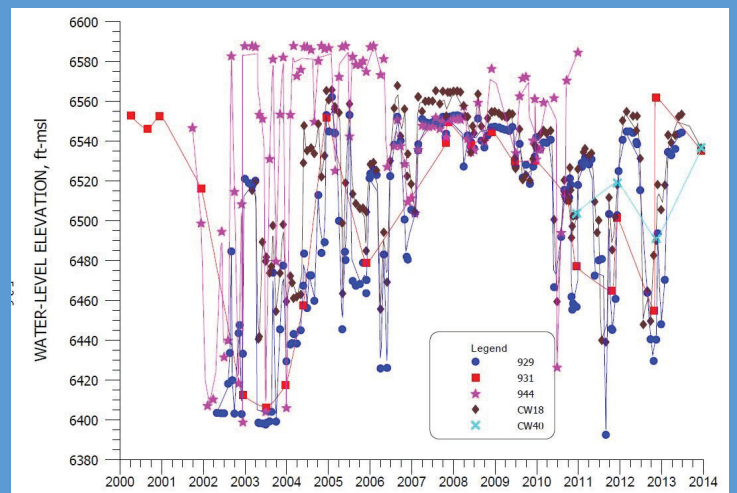
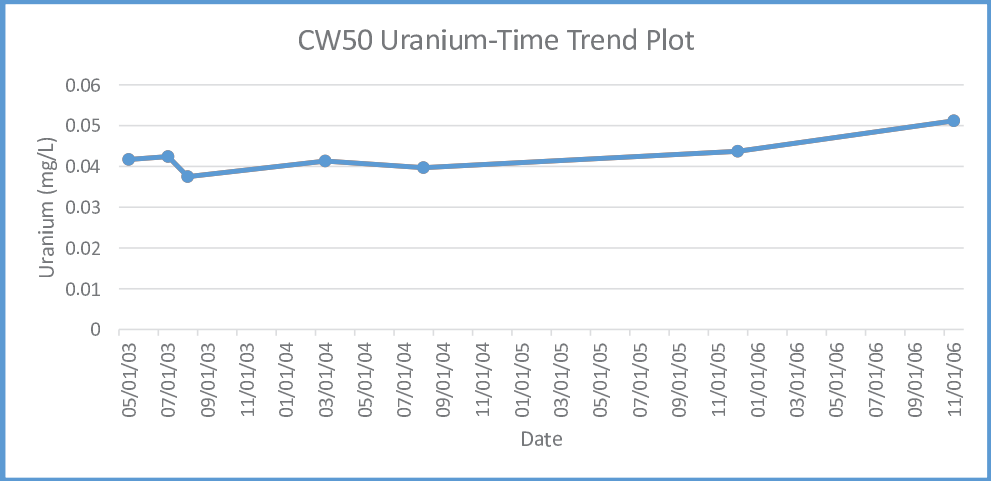
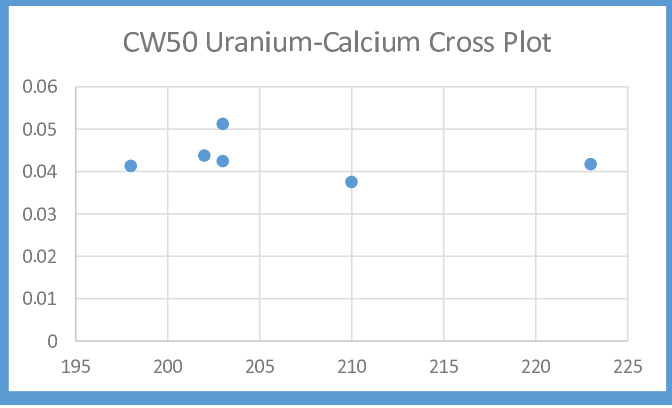
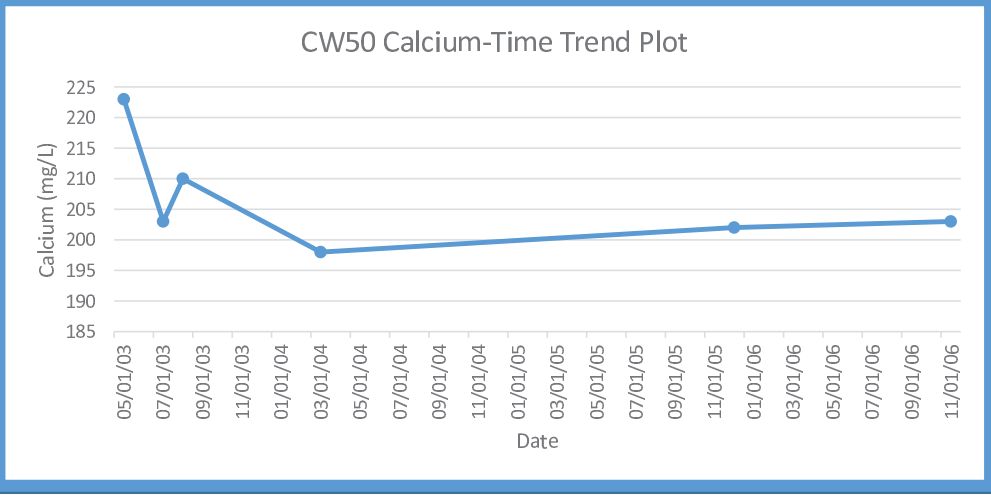


FIGURE 5.2-4. WATER-LEVEL ELEVATION FOR WELLS 929, 931, 944, CW18, AND CW40

CW50 Uranium and Calcium Trends







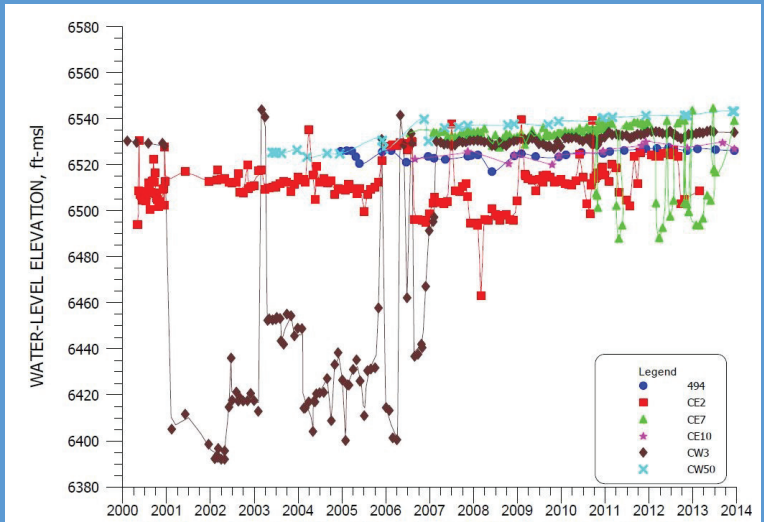
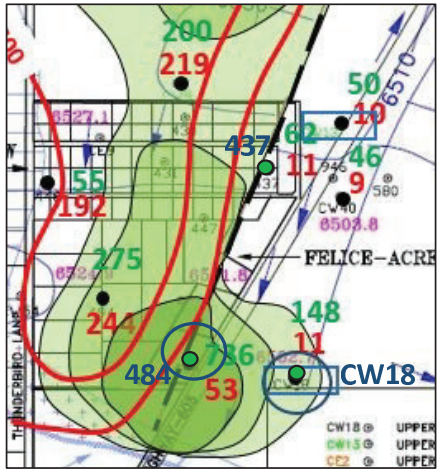


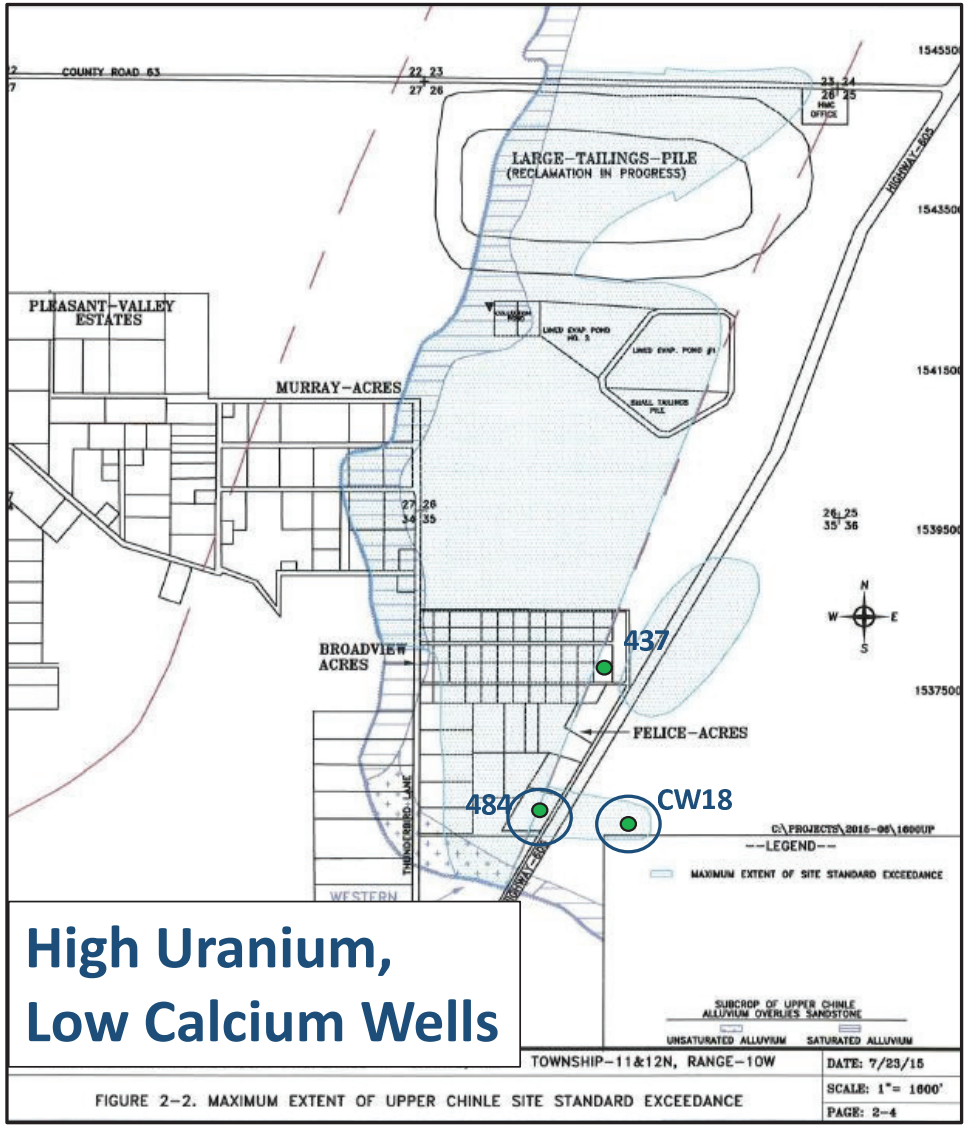
FIGURE 5.2-3. WATER-LEVEL ELEVATION FOR WELLS 494, CE2, CE7, CE10, CW3, AND CW50.

UPPER CHINLE IMPACTS MAP

2016
POST-CLOSURE
MONITORING PLAN

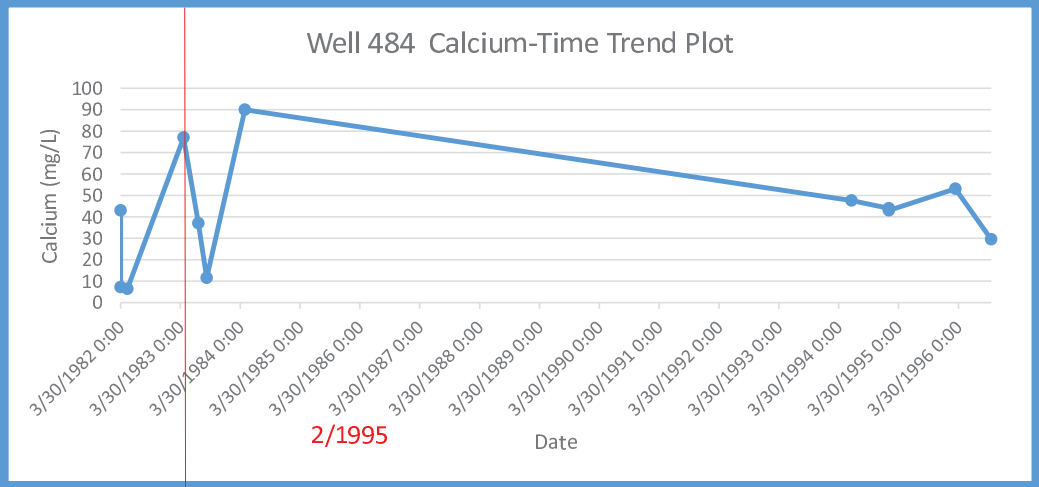


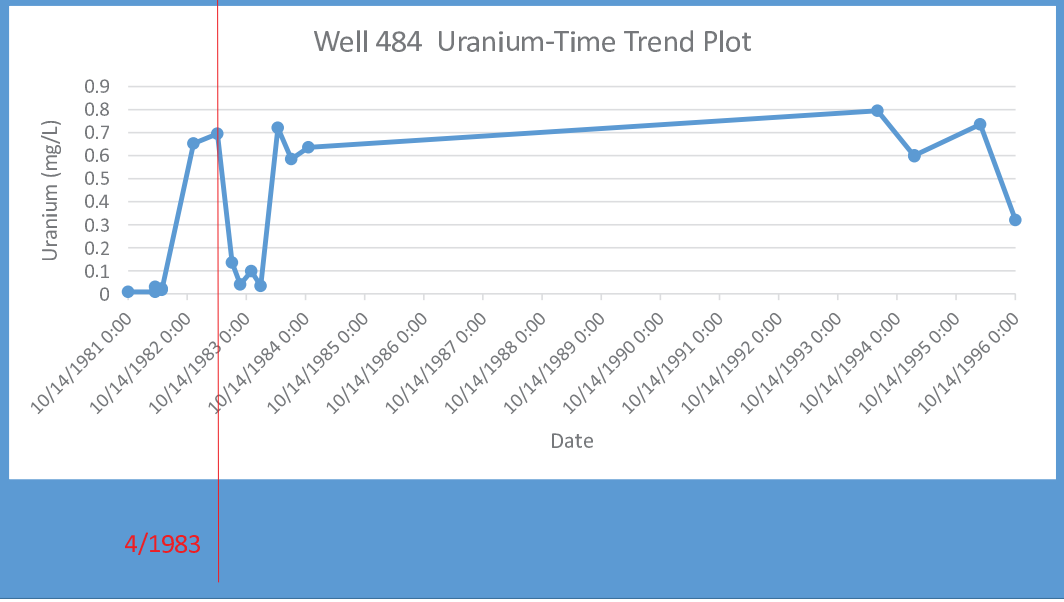
1996

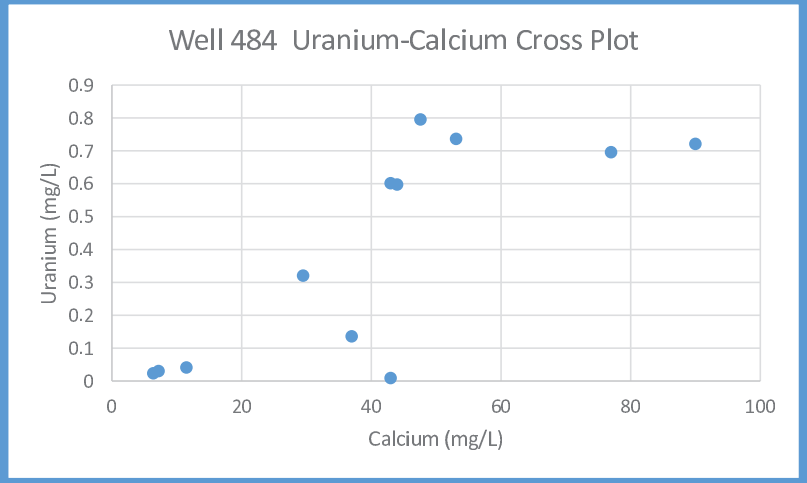


High Uranium,
Low Calcium Wells

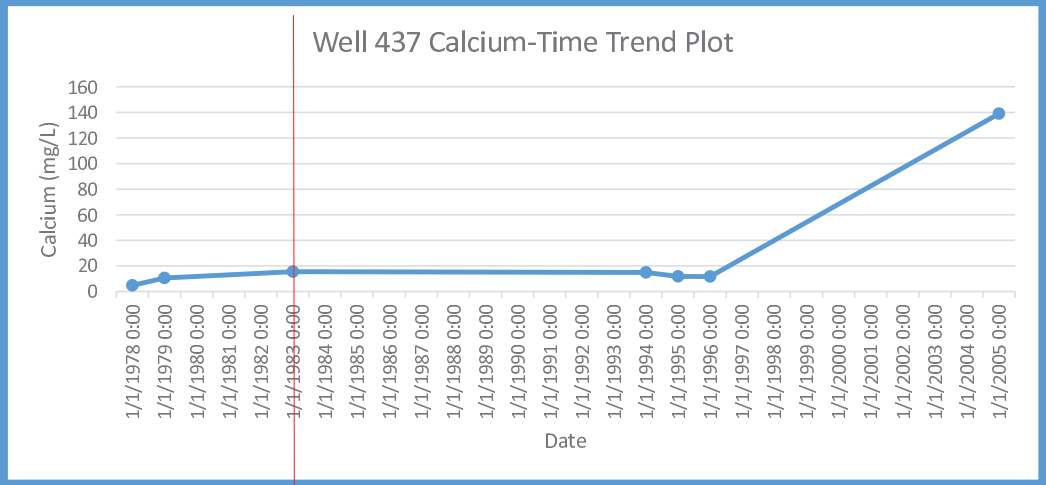
Well 484 Uranium and Calcium Trends

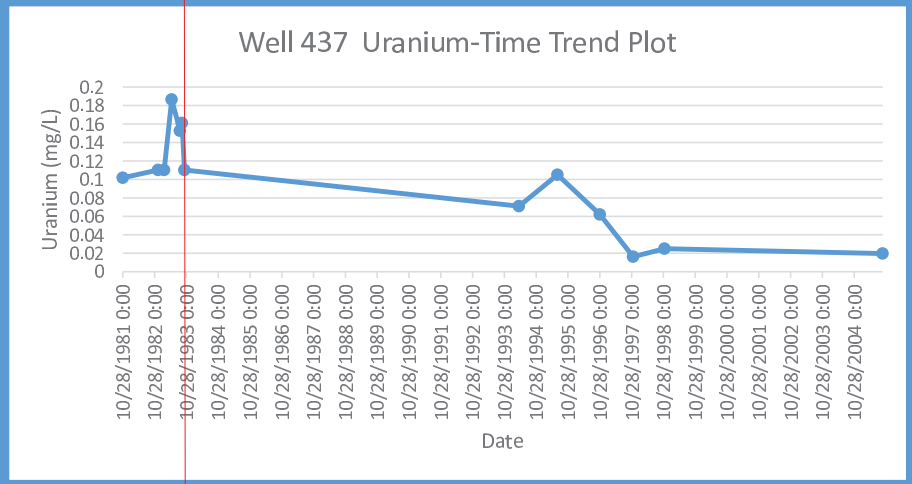




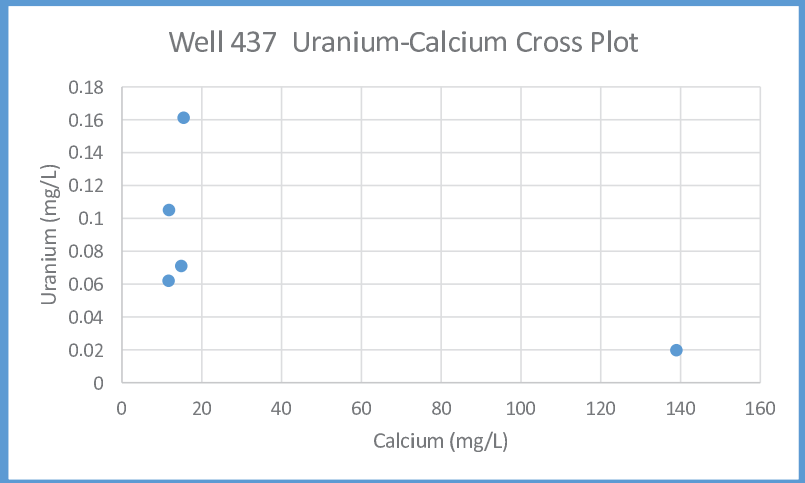


Well 437 Uranium and Calcium Trends

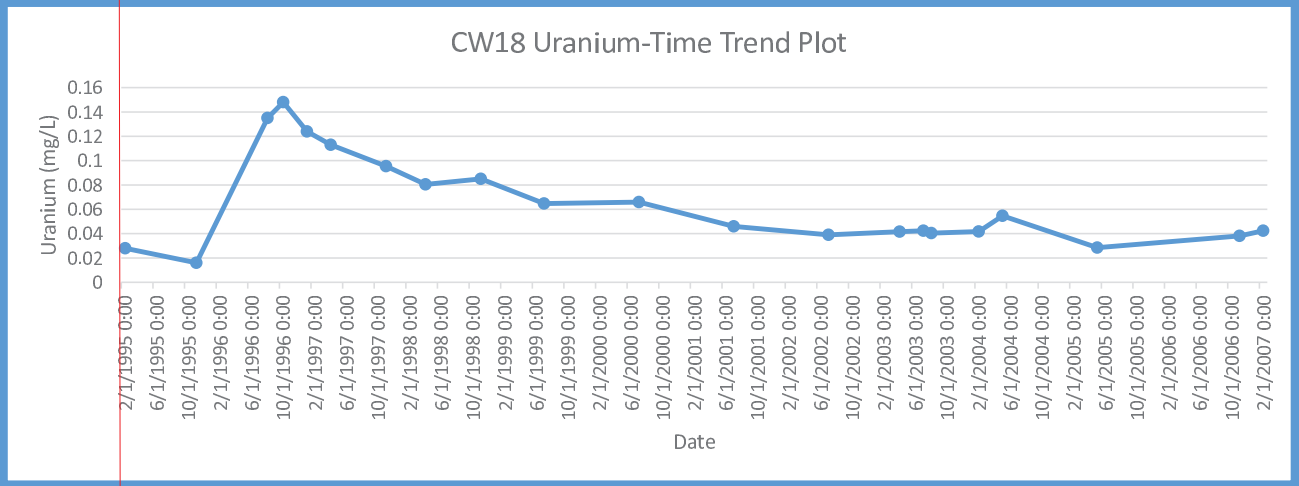


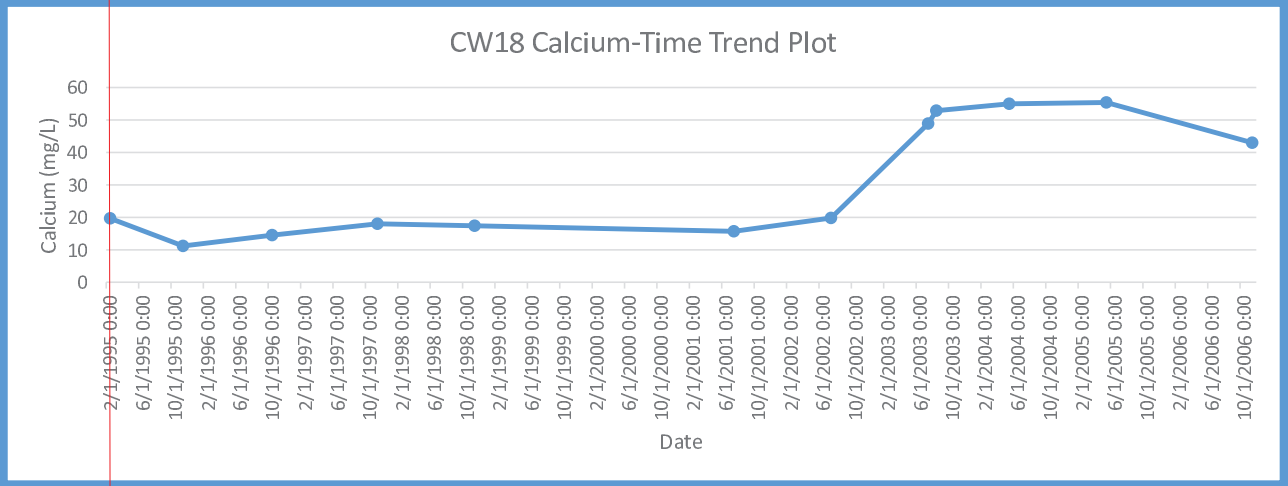


9/1983

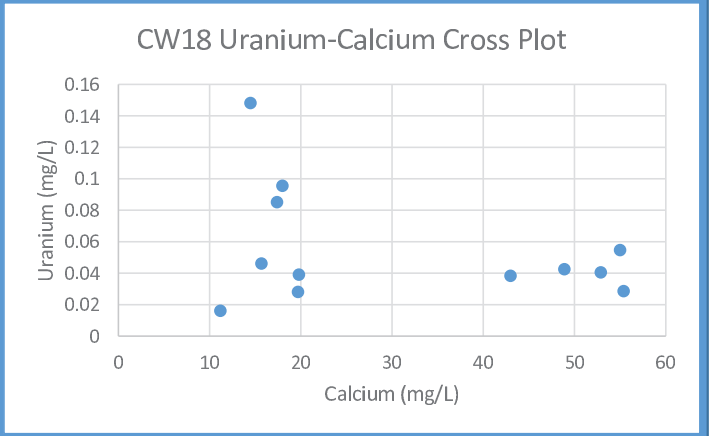


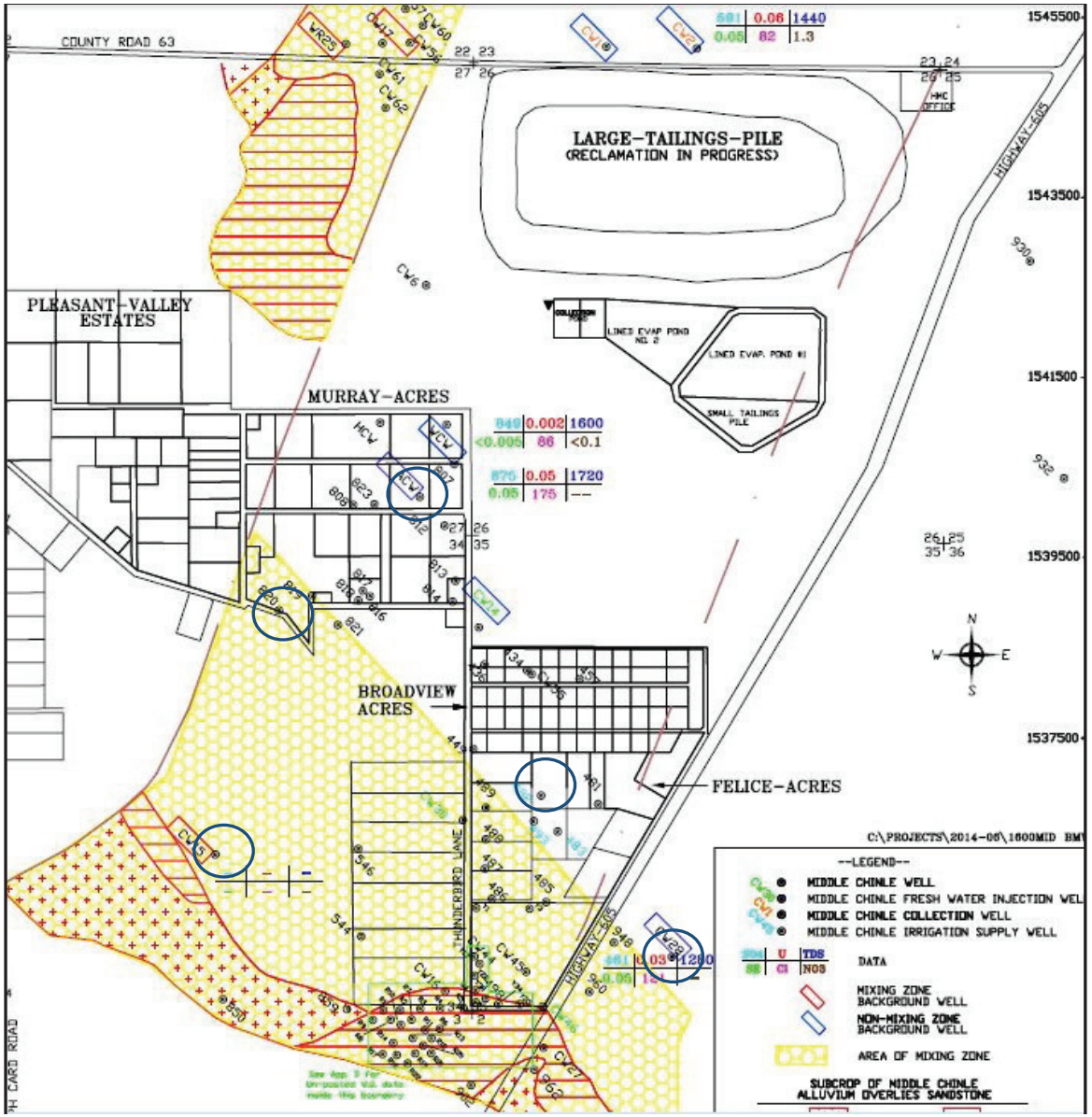
Well CW18 Uranium and Calcium Trends





2/1995

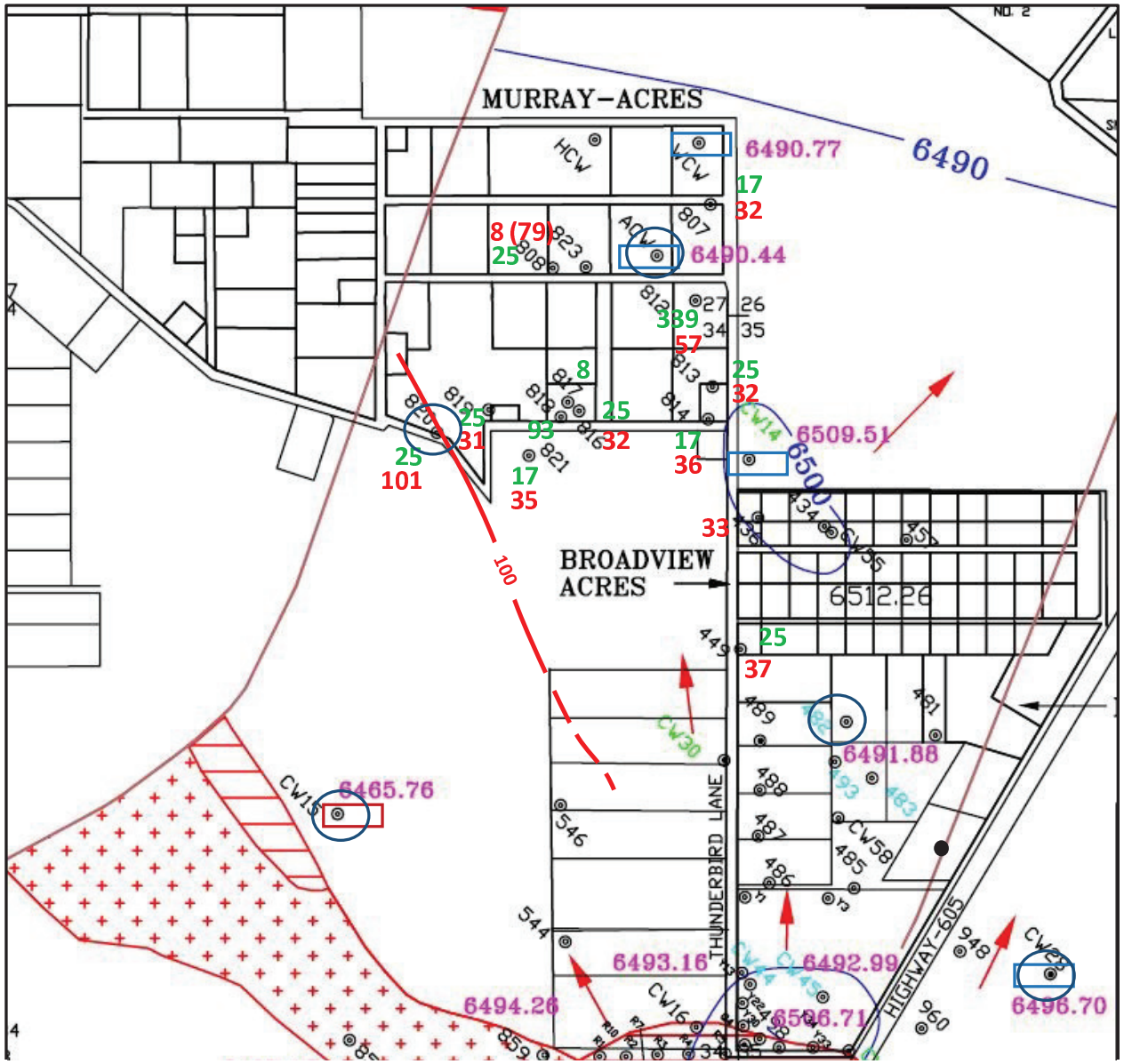




MIDDLE CHINLE MIXING ZONE AND BACKGROUND WELL LOCATION

HMC 2013 ANNUAL REPORT

Well Proposed for Additional Testing

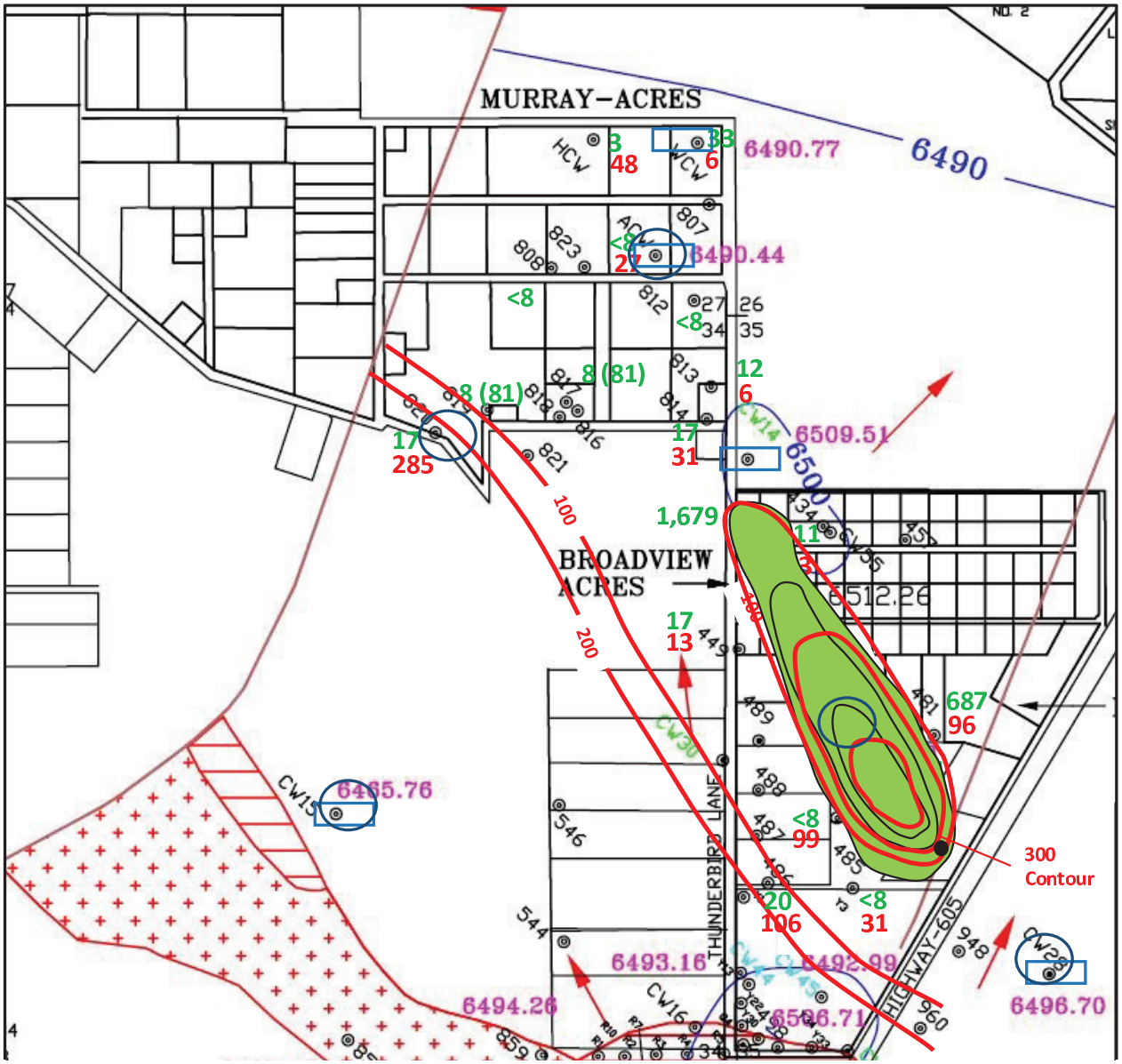


CALCIUM ISOCONCENTRATION CONTOUR MAP

Middle Chinle Aquifer

1976

DRAFT – FOR DISCUSSION PURPOSES ONLY



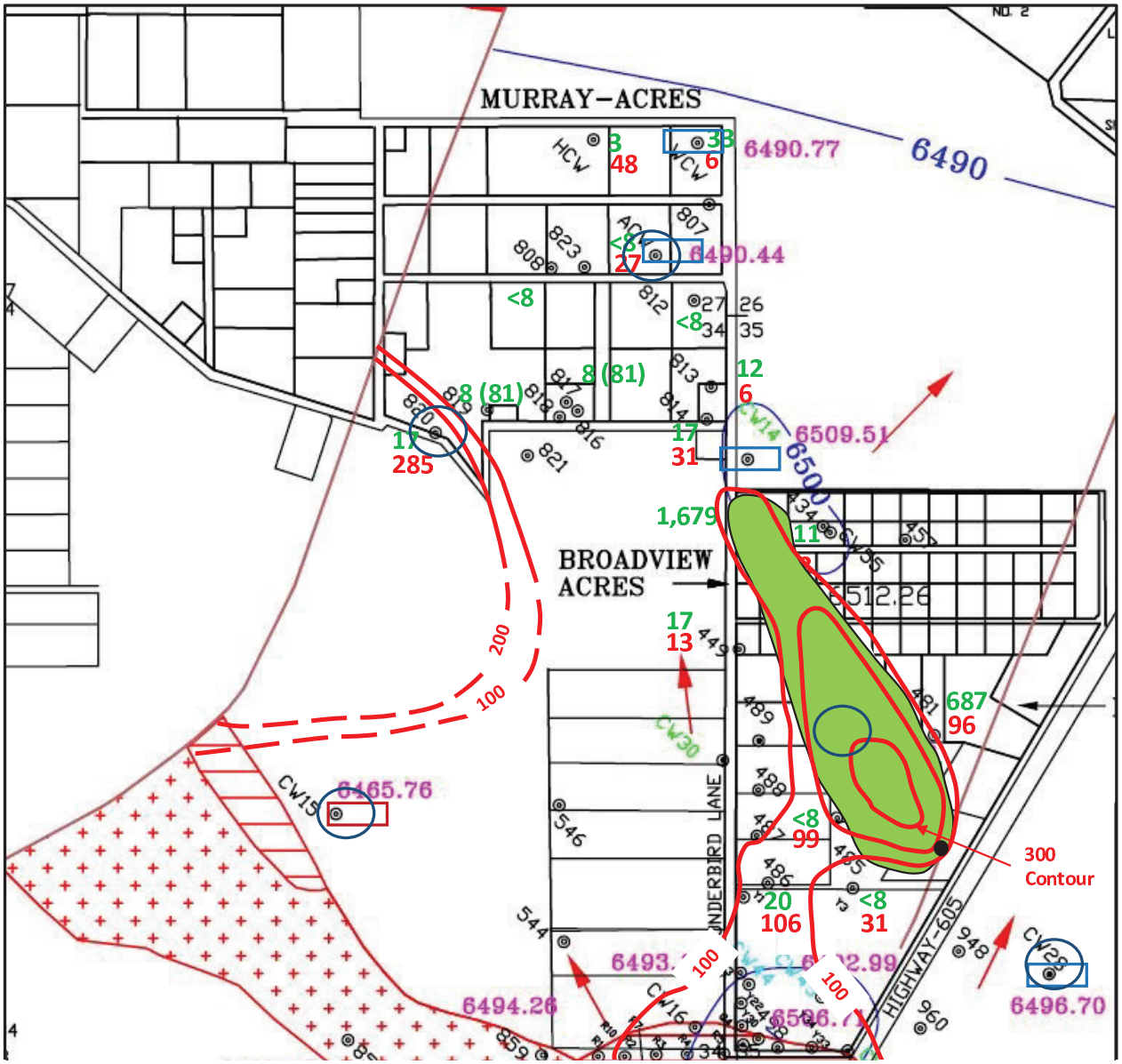
CALCIUM ISOCONCENTRATION CONTOUR MAP

Middle Chinle Aquifer

1981-83

- Uranium >1,000 ppb
- Uranium >2,000 ppb
- Uranium >3,000 ppb

DRAFT – FOR DISCUSSION PURPOSES ONLY



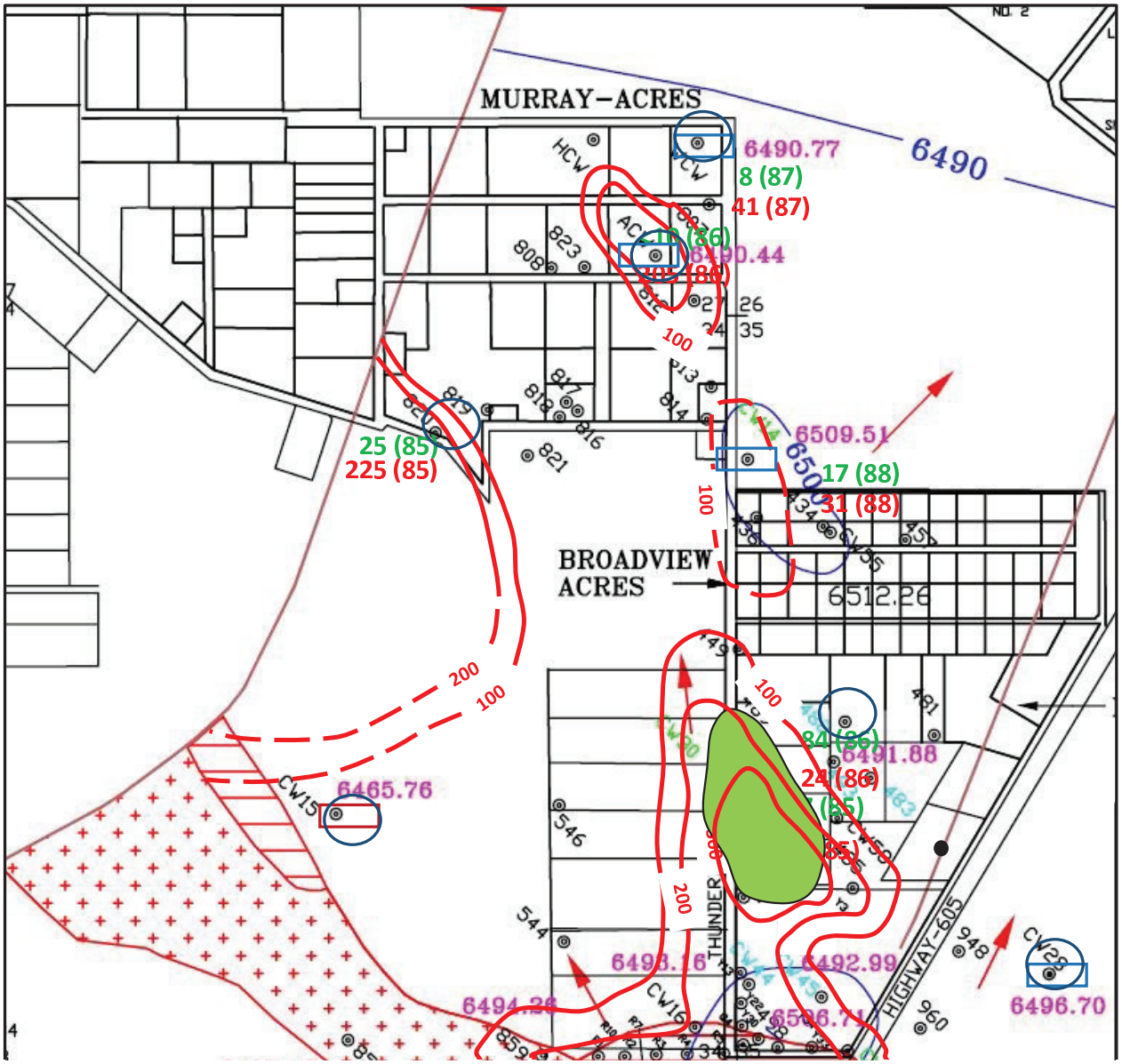
CALCIUM ISOCONCENTRATION CONTOUR MAP

Middle Chinle Aquifer

1981-83

- Uranium >1,000 ppb
- Uranium >2,000 ppb
- Uranium >3,000 ppb

DRAFT – FOR DISCUSSION PURPOSES ONLY



CALCIUM ISOCONCENTRATION CONTOUR MAP

Middle Chinle Aquifer

1985-87

Uranium >200 ppb

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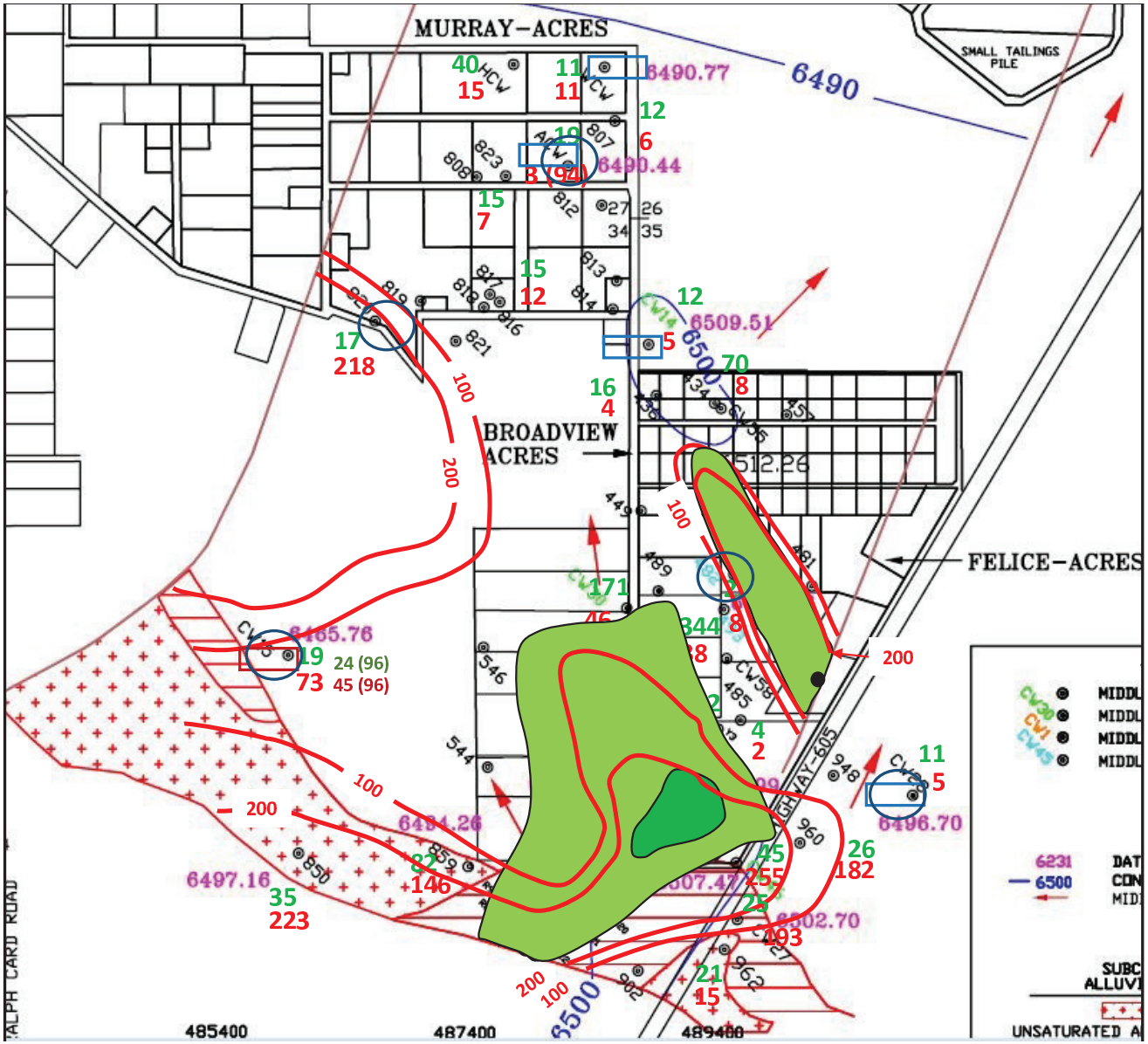


CALCIUM AND URANIUM ISOCONCENTRATION CONTOUR MAP

Middle Chinle Aquifer

1995-96

- Uranium >200 ppb
- Uranium >500 ppb
- Uranium >1,000 ppb
- Uranium >1,500 ppb

DRAFT – FOR DISCUSSION PURPOSES ONLY

WELLS CONSIDERED FOR ADDITIONAL TESTING MIDDLE CHINLE?

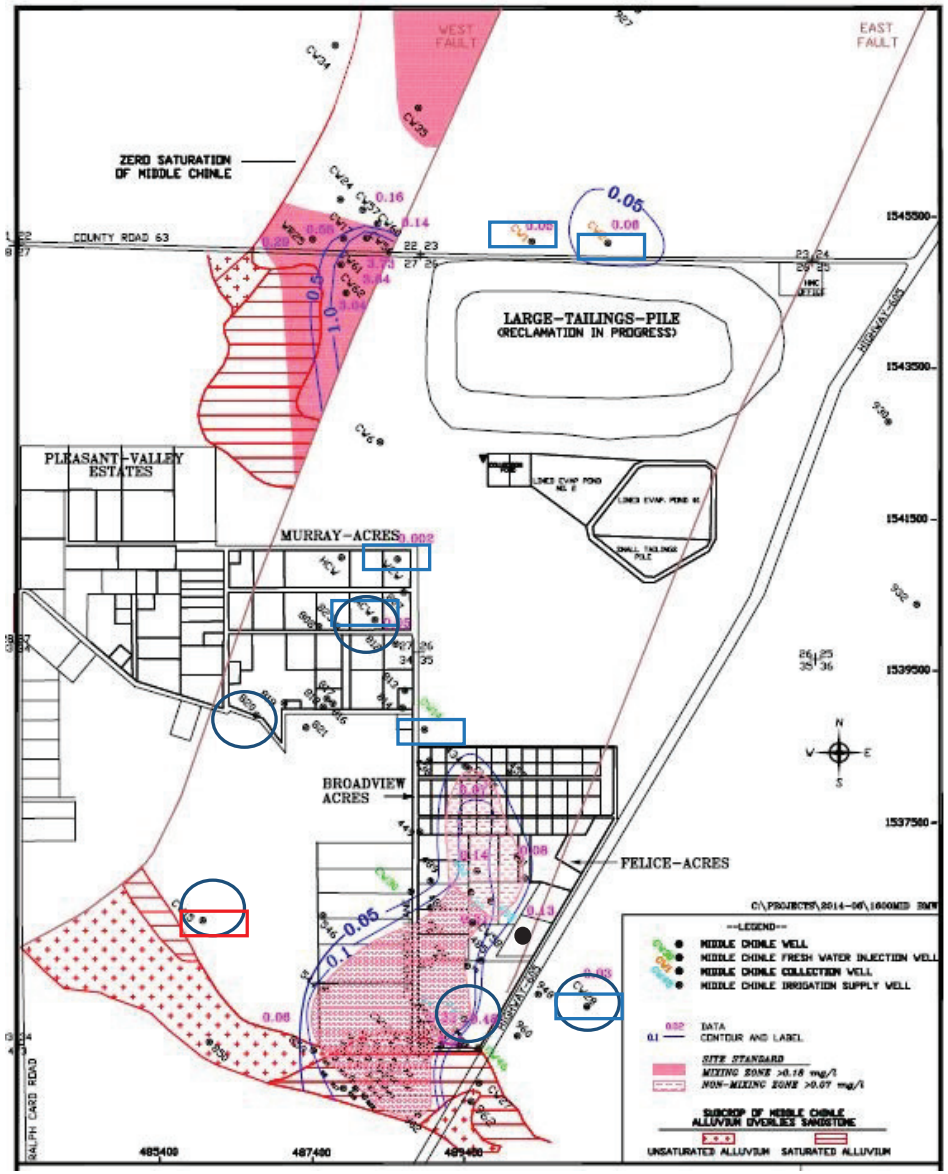
- High Calcium – Low Uranium
  - CW15 – Mixing Zone, Not Impacted?
  - 820 – Mixing Zone, Not Impacted?
- Low Calcium – Low Uranium
  - AWC – Non Mixing Zone, Not Impacted?
  - CW28 – Non Mixing Zone, Impacted?
    - Uranium levels increase from <20 ppm to 80 ppb from 1996 to 2003; appears to be impact from HMC operations
- High Calcium – High Uranium
  - CW45 – Mixing Zone, Impacted
    - Irrigation Supply Well
- Low Calcium – High Uranium
  - 484 – Mixing Zone, Impacted
    - Along East Fault

URANIUM CONCENTRATION MAP

Middle Chinle

Homestake 2013 Annual Report

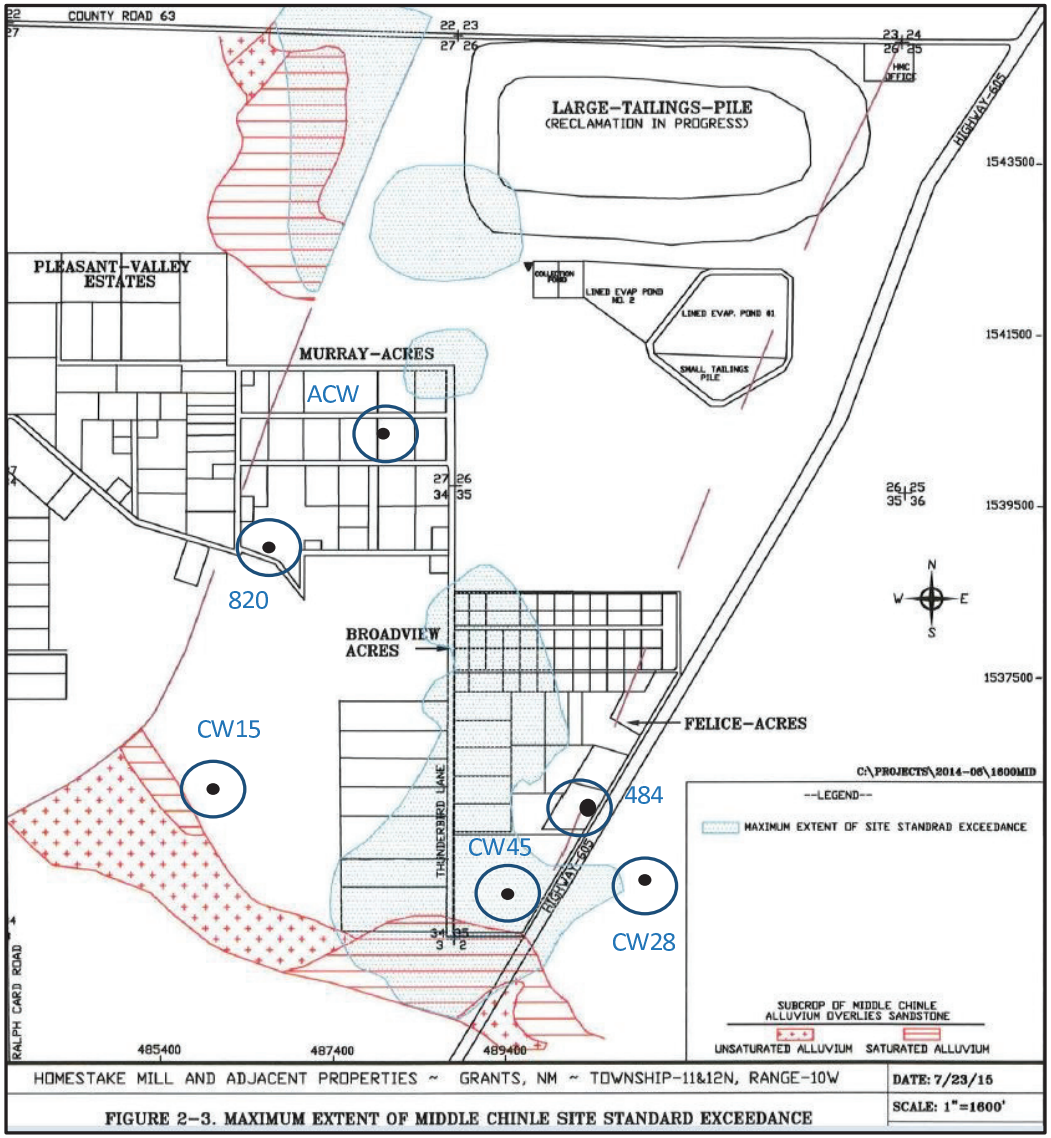
Well Proposed for Additional Testing



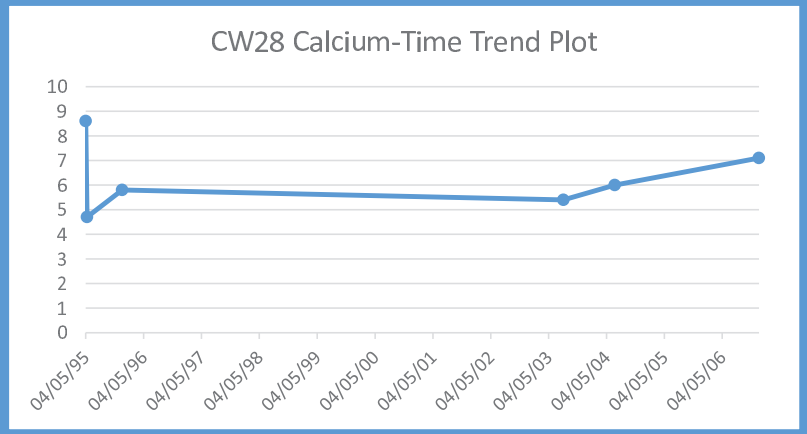
MIDDLE CHINLE IMPACTS MAP

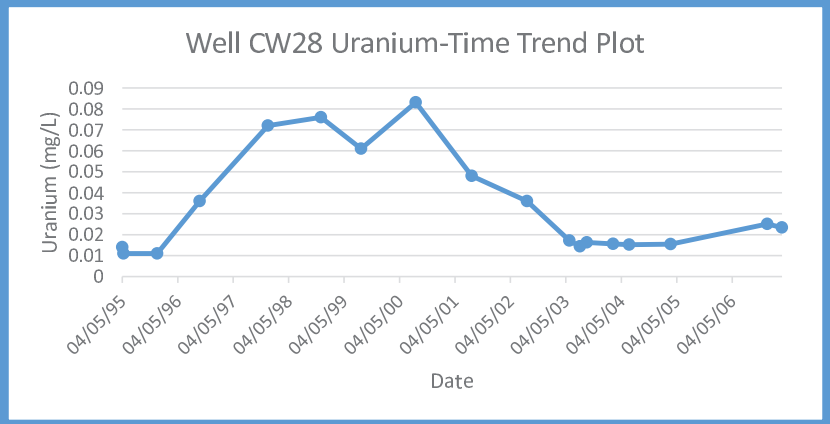
2016 Post-Closure Monitoring Plan

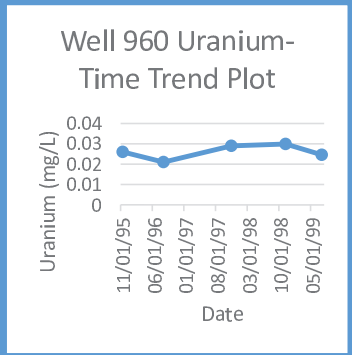
Well Proposed for Additional Testing



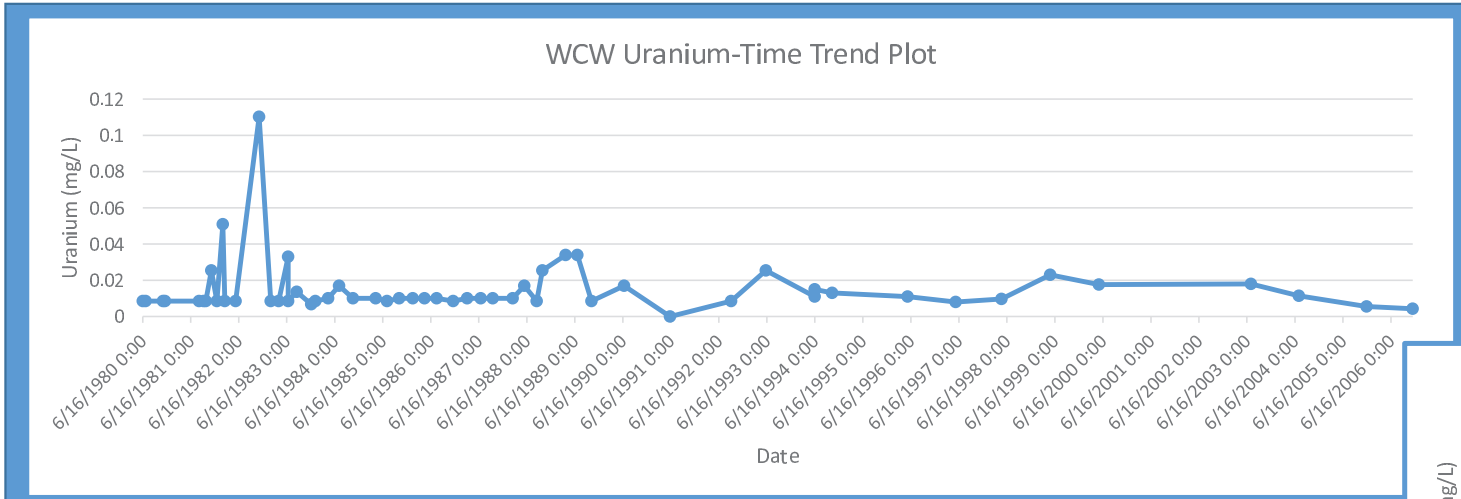
CW28 Uranium and Calcium Trends

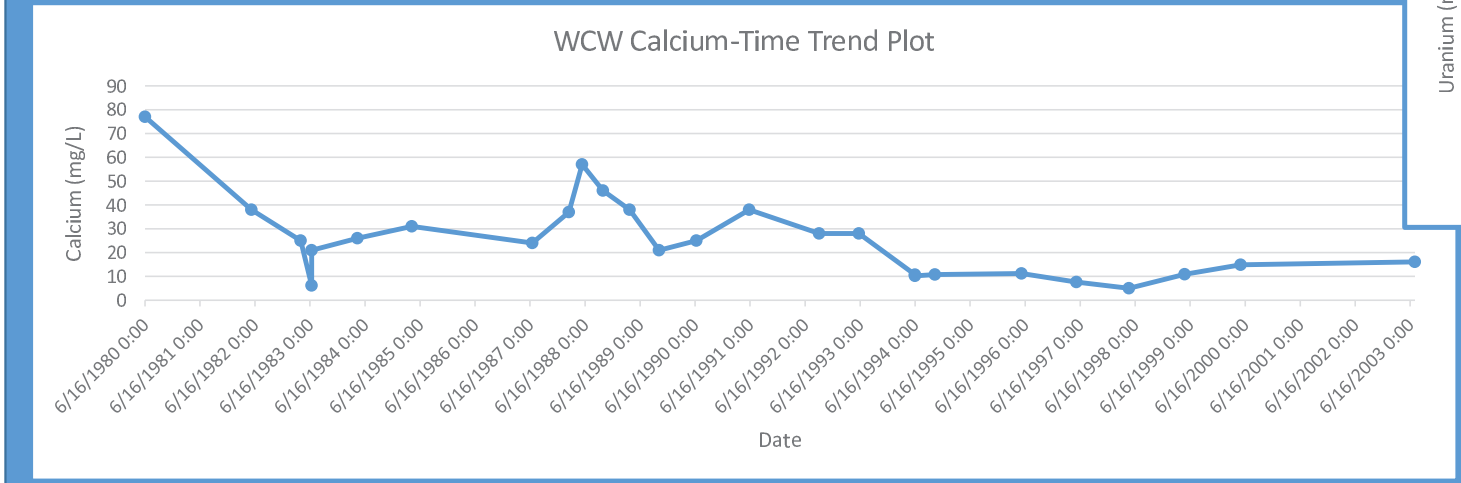


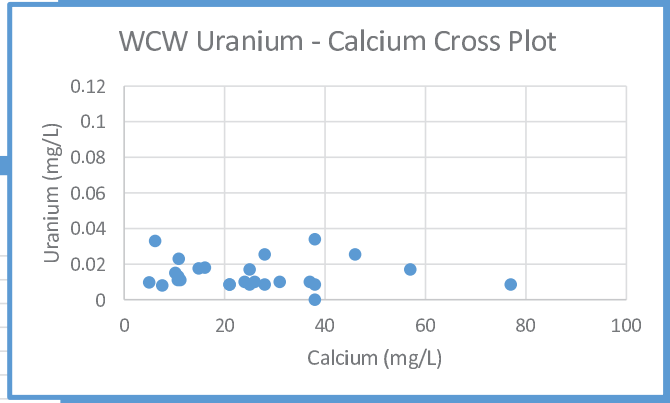




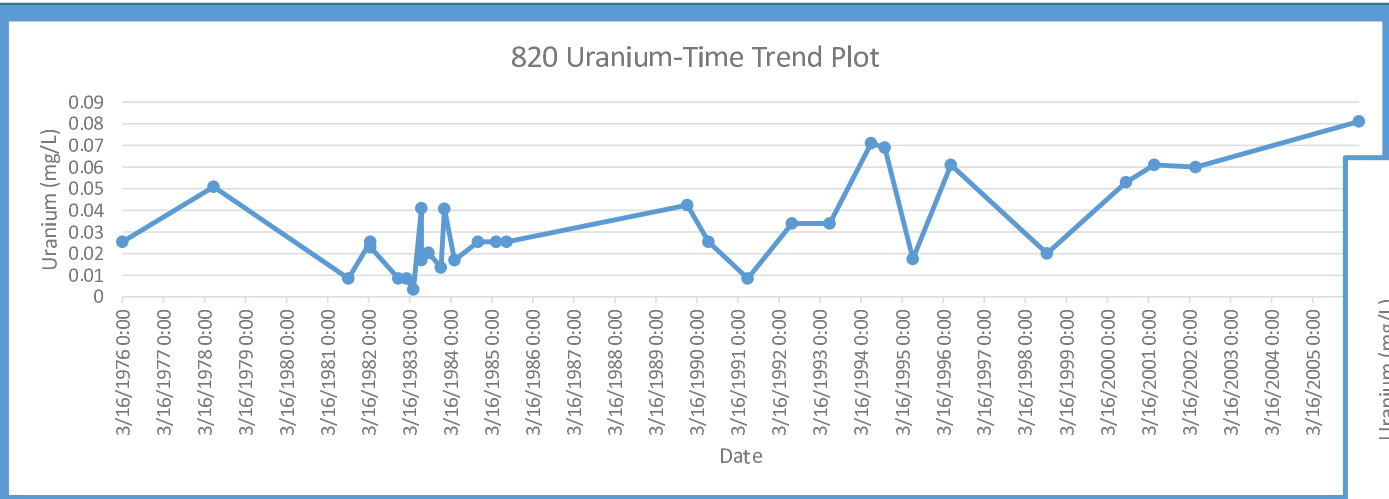
WCW Uranium and Calcium Trends

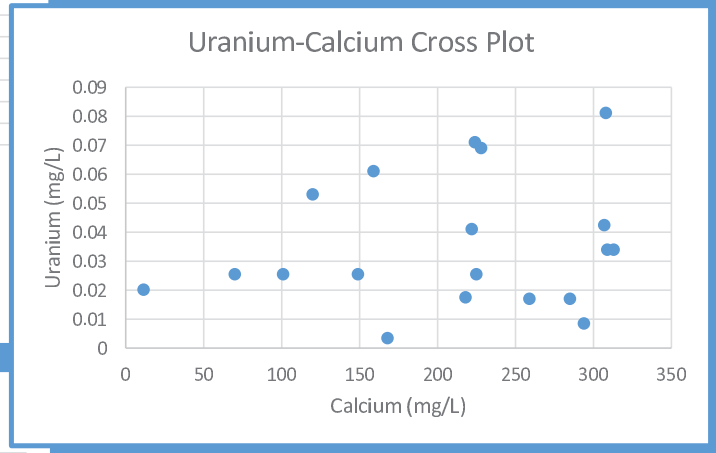


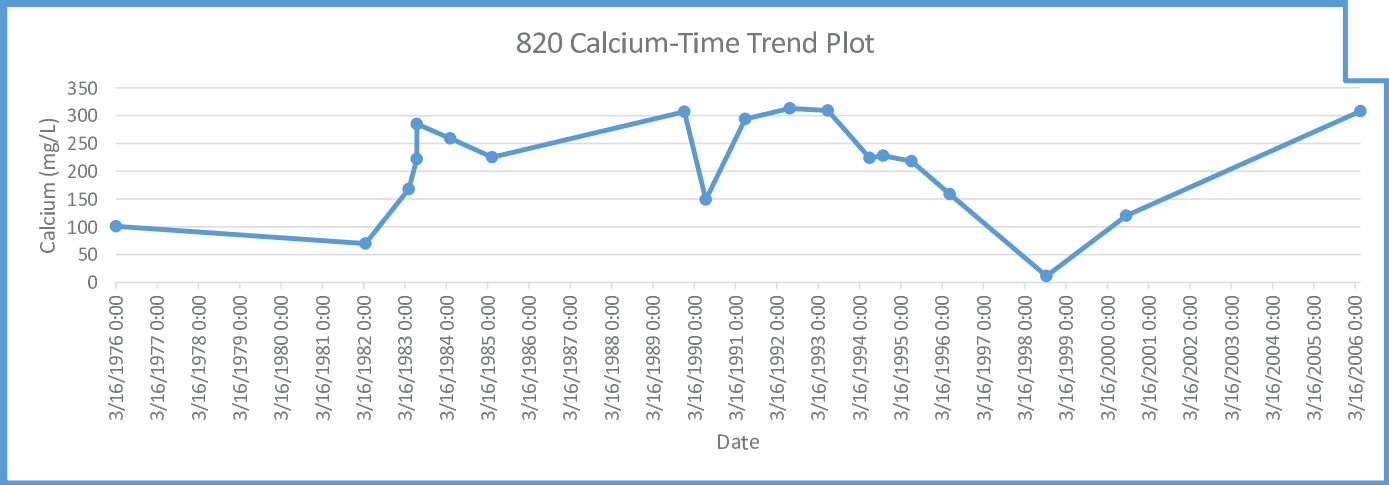




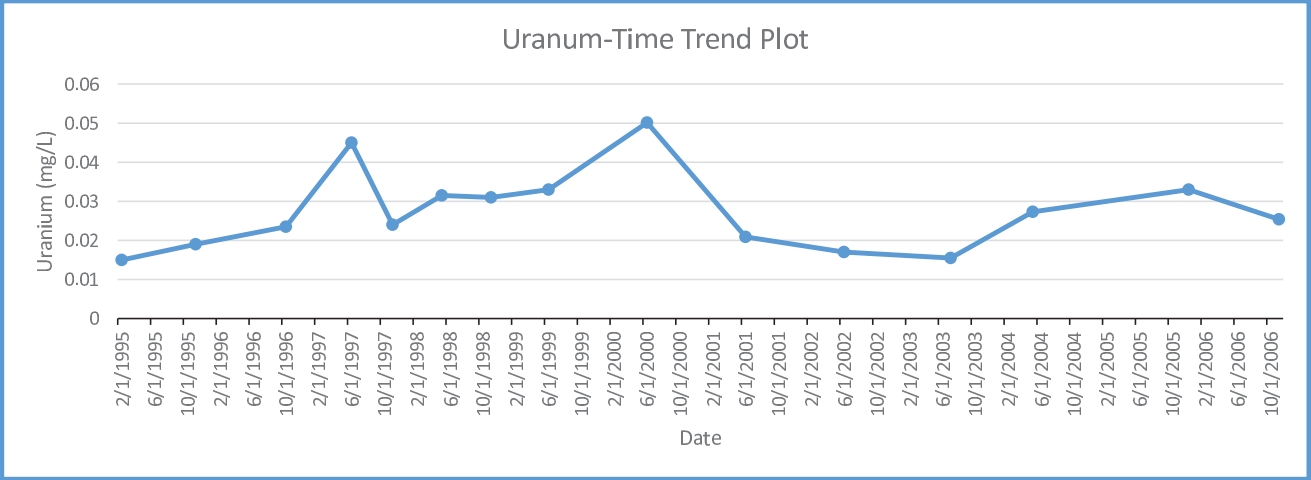
820 Uranium and Calcium Trends

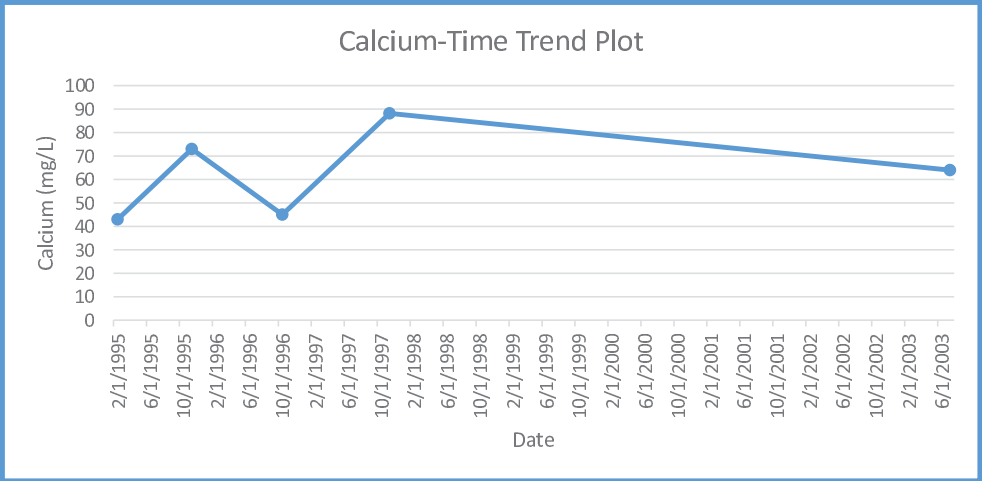


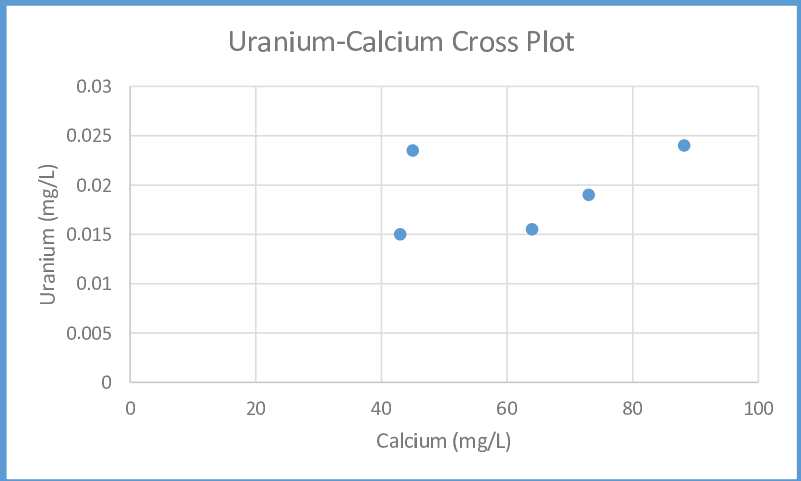


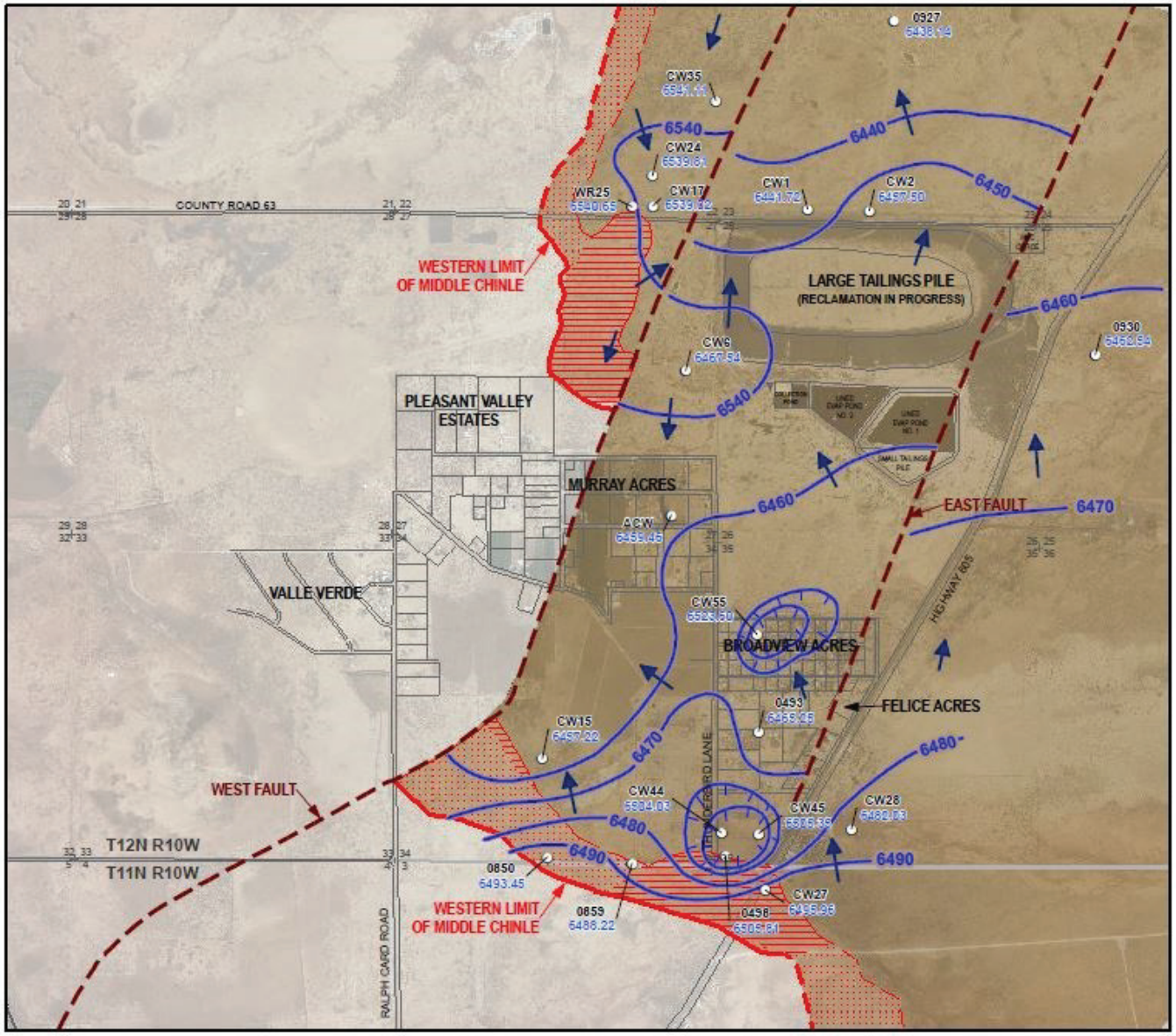


CW15 Uranium and Calcium Trends









GROUND WATER FLOW MAP

Middle Chinle

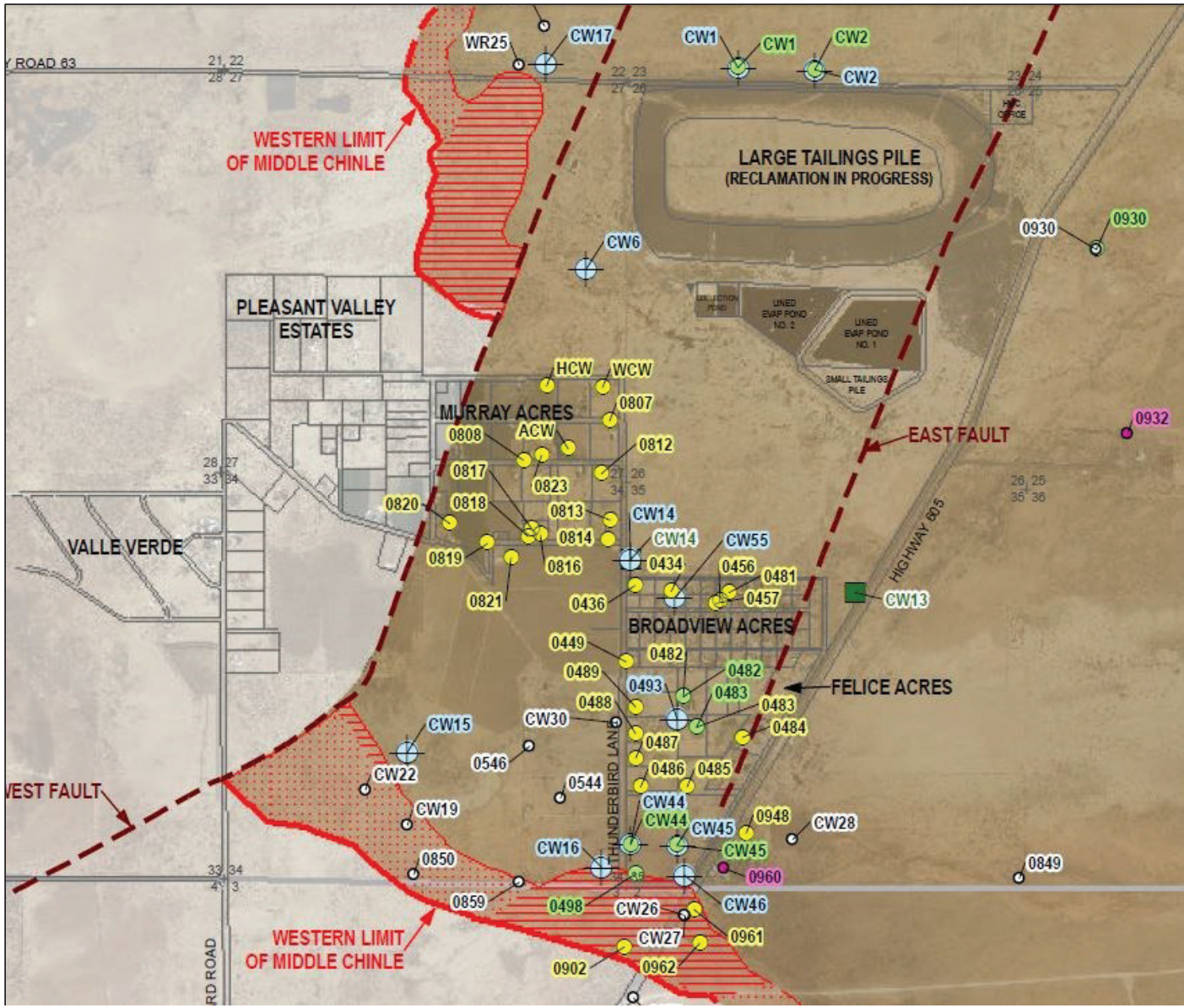
Homestake CAP

Aquifer In West Fault Block Separated From Central And East Block

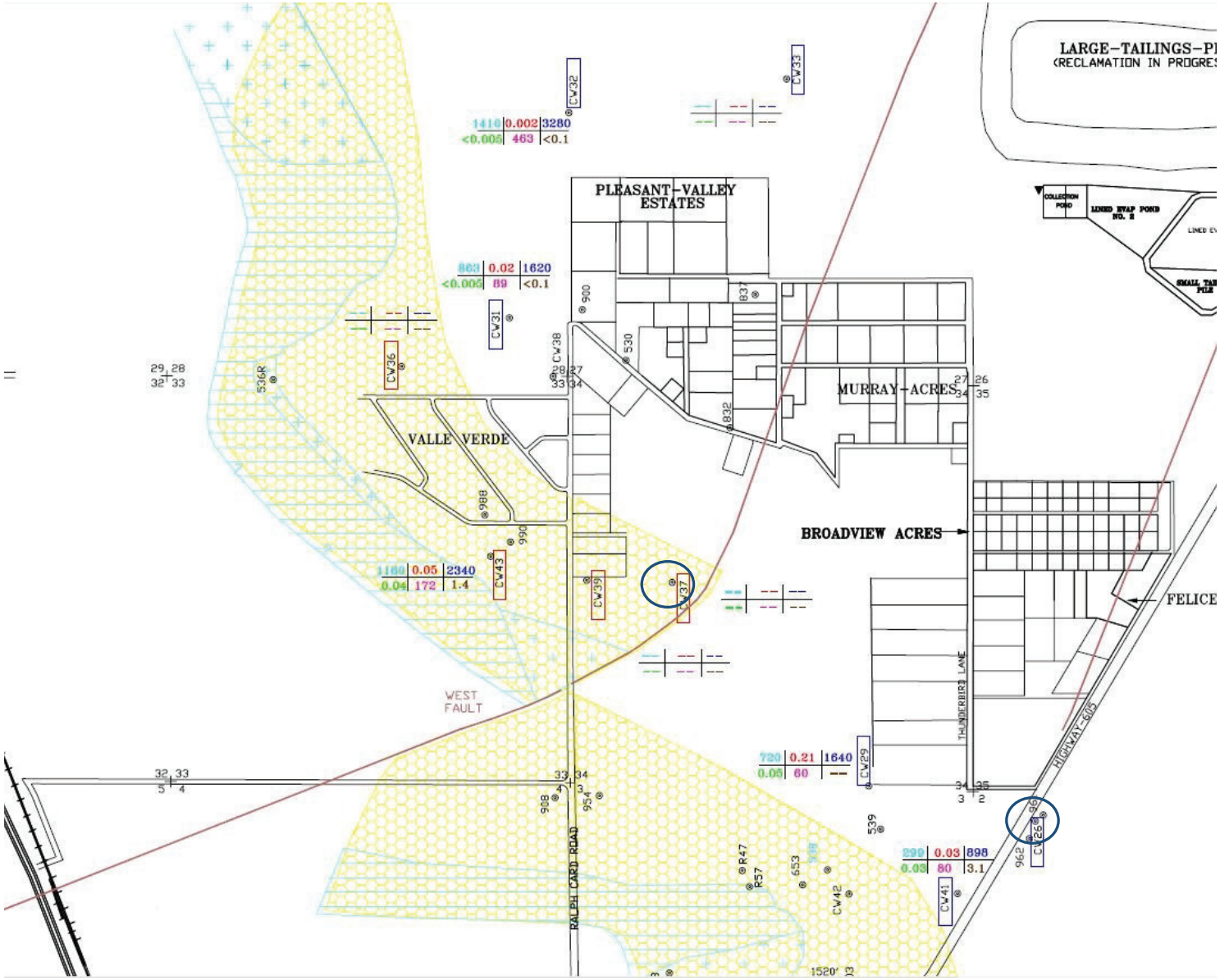
M. CHINLE WELL IDENTIFICATION

Wells by Use

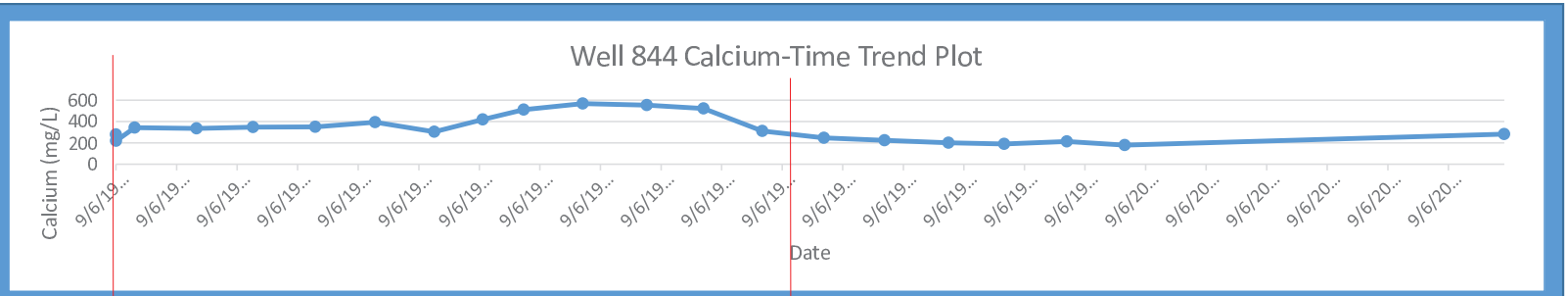
T11	Collection
0945	Domestic
0933	Industrial
CW25	Injection
CW9	Monitor
CW2-1	Reversal
CW23	Unknown/Unassigned

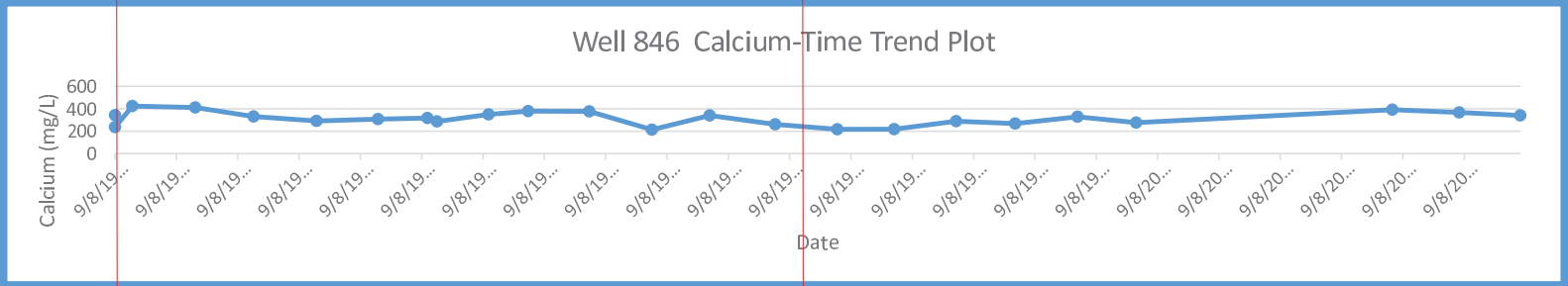


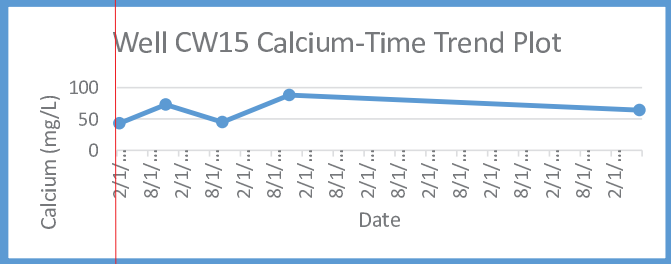
LOWER CHINLE


LARGE-TAILINGS-PI
(RECLAMATION IN PROGRES
COLLECTION POND
LINED EVAP POND NO. 2
PLEASANT-VALLEY ESTATES
MURRAY-ACRES
VALLE VERDE
BROADVIEW ACRES
FELICE
WEST FAULT
RALPH CARD ROAD
THUNDERBIRD LANE
HIGHWAY-605
1520'
CW32
CW33
CW31
CW36
CW38
CW43
CW39
CW37
CW29
CW41
CW42
1410 | 0.002 | 3280
<0.005 | 463 | <0.1
863 | 0.02 | 1620
<0.005 | 89 | <0.1
1169 | 0.05 | 2340
0.04 | 172 | 1.4
720 | 0.21 | 1640
0.05 | 60 | --
299 | 0.03 | 898
0.03 | 80 | 3.1

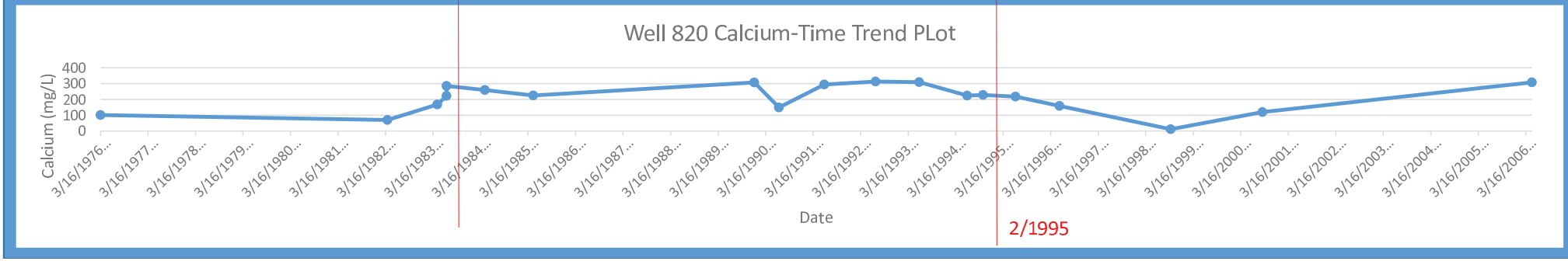
Correlation Between Alluvial Wells 844, 846 and U. Chinle Wells CW15 and 820 for Calcium





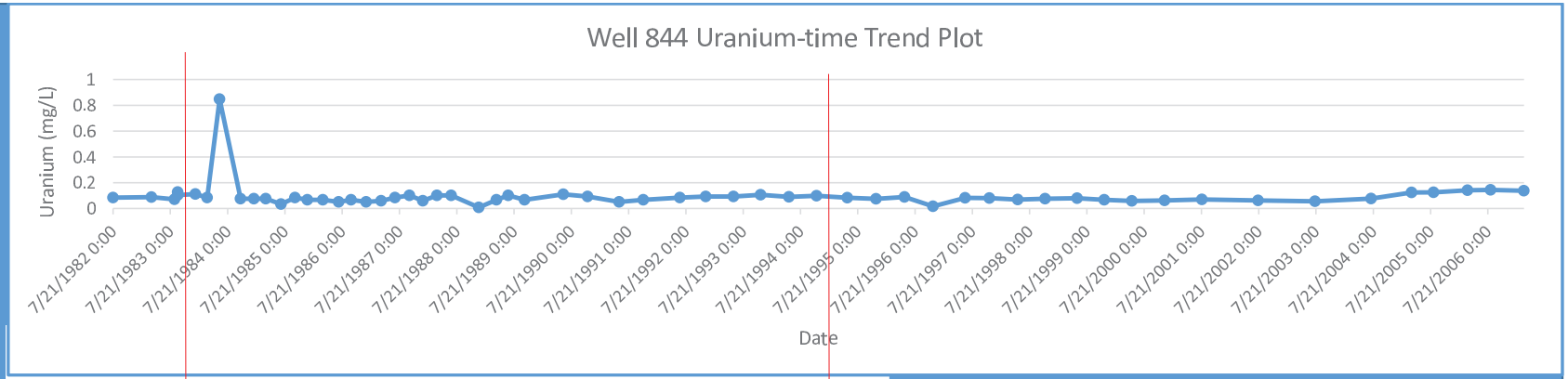


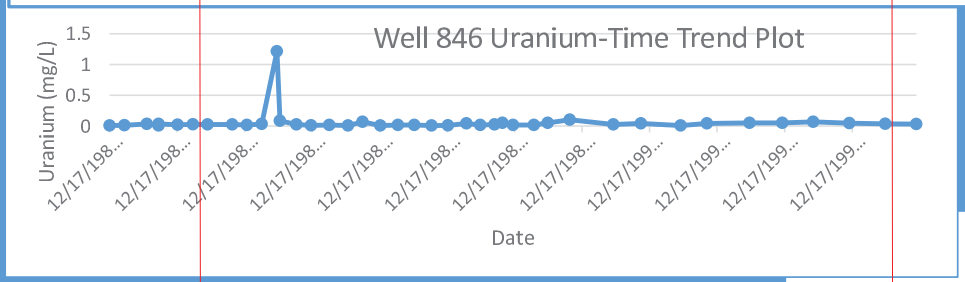
9/1993

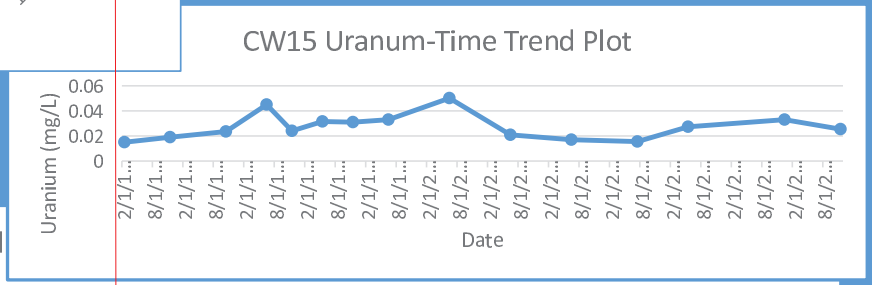


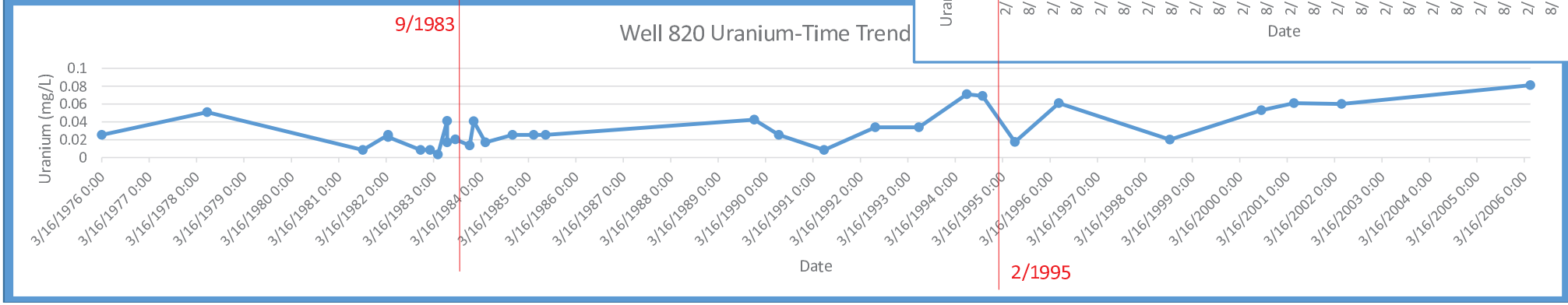
2/1995

Correlation Between Alluvial Wells 844, 846 and U. Chinle Wells CW15 and 820 for Uranium









OTHER SLIDES

UPPER CHINLE BACKGROUND WELL DATA

	Well	Uranium (ppb)	Selenium (ppb)	Molybdenum (ppb)	Sulfate (ppm)	TDS (ppm)
Cleanup Standards (MZ)		180	140	100	1750	3140
Mixing Zone	CW-50*	41-42	<5-7	<30		
	CW-52*	9-41	17-28	<30		
	CW-9	<8.5-55	<10-25	<30-110		
	CW-10	12-50	<1-7	<10-20		
Cleanup Standards (NMZ)		90	60	100	914	2010
Non-Mixing Zone	CW-3	02-76	05-68	10-50	566-1,050	920-2,130
	CW-13	45-96	36-244	<30		
	CW-18	16-148	<10-129	<30-50		
	931	04-50 (144?)	05-30	10-110 (420)	608-779	1,290-2,160
	934	08-93 (361)	05-63	10-230	620-821	1,549-1,930

*Data from only two sampling events available

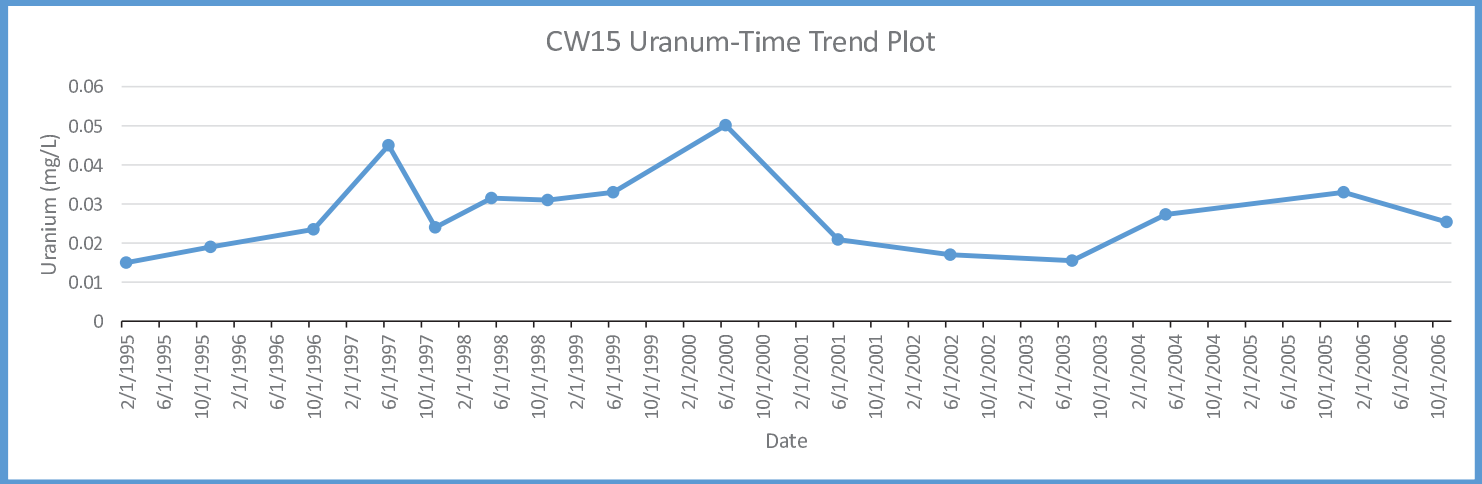
Data from Homestake 2003 Statistical Evaluation Report

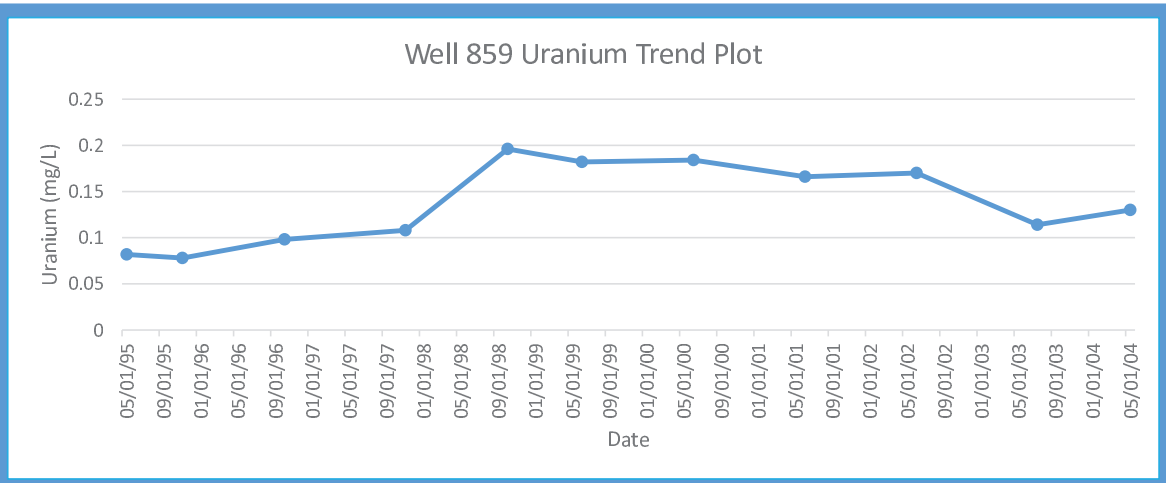
MIDDLE CHINLE BACKGROUND WELL DATA

Data from Homestake 2013 Statistical Evaluation Report

	Well	Uranium	Selenium	Molybdenum	Sulfate	TDS	
Cleanup Standards (MZ)		180	140	100	1750	3140	
Mixing Zone	CW-15	15-50	11-42	<30		1446-1710	C/E Block
Mixing Zone	CW-17	69-175	69-116	<30-70		1620-3250	Western Block
Mixing Zone	CW-24	101-154	34-79	<30-40		3020-3160	Western Block
Mixing Zone	CW-35	141-231	12-520	<30		1830-2370	Western Block
Mixing Zone	WR-25						Western Block
Cleanup Standards (NMZ)		70	70	100	857	1560	
Non-Mixing Zone	CW-1	<8.5-62	11-90	<30-40		2020-2514	Central and Eastern Block
Non-Mixing Zone	CW-2	<8.5-69	<10-30	<10-50		860-2280	Central and Eastern Block
Non-Mixing Zone	CW-28	11-61	16-83	<30-30		944-1410	Central and Eastern Block
Non-Mixing Zone	ACW	<8.5-25	<10-10	<10-30		1172-1470	Central and Eastern Block
Non-Mixing Zone	WCW	<8.5-33	<10-20	<10-30		1170-1980	Central and Eastern Block
Non-Mixing Zone	CW-14	10-19	83-222	<30		1306-1486	Central and Eastern Block

Wells CW15 and 859 Uranium Trends





TRIASSIC CHINLE OUTCROP
Homestake NPL Site
Middle Chinle Subcrop
CW52
CW34
DD2
CW50
CW35
DD
WR25
CW17
CW1
CW2
CW3
Google e
Tour Guide
1997
Imagery Date: 1/5/2014 35°15'35.10" N 107°52'08.88" W elev 6629 ft eye alt 1