

July 20, 2011

Ms. Jami Bailey
Division Director, NM Oil Conservation Division
Chairman, NM Oil Conservation Commission
1220 South St. Francis Drive
Santa Fe, NM 87505

Case 14720

VIA E-MAIL AND FEDERAL EXPRESS

RE: AGAVE ENERGY COMPANY C-108 APPLICATION FOR RED HILLS AGI#1

Dear Ms. Bailey:

Pursuant to the new policy that the NM Oil Conservation Commission will be conducting the hearings on all future AGI applications, enclosed you will find two copies of the above- referenced C-108 application for an acid gas injection well at the proposed Agave Red Hills Gas Processing Plant located approximately 20 miles west of Jal in Lea County, NM. By copy of this letter a copy of this application is being transmitted also to the Hobbs District Office. Copies of the proposed legal notice and the notice letter to be sent to all required parties are included in Appendix C to the application.

Agave Energy Company requests that this application be placed on the docket for the regularly scheduled Commission Hearing of August 25th or September 22nd or at a time between the regularly scheduled August and September hearings if that is the Commission's pleasure.

Sincerely,
Geolex, Inc.



Alberto A. Gutiérrez, RG
President
Consultant to Agave Energy Company



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Enclosure

cc: w/enclosure Buddy Holt, NMOCD Hobbs District Office
w/o enclosure Richard Ezeanyim, NMOCD Engineering Bureau Chief, Santa Fe
w/o enclosure Florene Davidson, NMOCC, Santa Fe
w/enclosure, Wesley Ingram, PE, BLM, Carlsbad
w/enclosure Ivan Villa, Agave Energy Co., Artesia
w/enclosure Jennifer Knowlton PE, Agave Energy Co., Artesia
w/enclosure Gary Larson, Hinkle, Hensley, Shanor & Martin, LLP, Santa Fe

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C-108 Application for Authorization to Inject
via Proposed Red Hills AGI #1 Well,
Agave Energy Red Hills Gas Plant
Lea County, New Mexico



July 20, 2011

Prepared For:
Agave Energy Company
105 S. Fourth Street
Artesia, NM 88210

Submitted To:
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Prepared By:
Geolex, Inc.
500 Marquette Ave. NW, Suite 1350
Albuquerque, NM 87102

APPLICATION FOR AUTHORIZATION TO INJECT

I. PURPOSE: Request for authorization to inject acid gas (H₂S and CO₂) for the purposes of disposal and sequestration.

II. OPERATOR:

Agave Energy Company
105 S. Fourth Street
Artesia, NM 88210

Contact Party:
Alberto A. Gutiérrez, CPG – Geolex, Inc.
Office 505-842-8000

III. WELL DATA:

Available information on registered wells within 2 miles of the proposed Red Hills AGI #1 well and within the 1-mile area of review is included in Section 5.0 and Appendices B and C. A schematic of proposed AGI system and well design is included as Figures 3 and 4 and discussed in Section 3.0.

IV. IS THIS AN EXPANSION OF AN EXISTING PROJECT?

This is not an expansion of an existing project.

V. ATTACH A MAP THAT IDENTIFIES ALL WELLS AND LEASES WITHIN TWO MILES OF ANY PROPOSED INJECTION WELL WITH A ONE-HALF MILE RADIUS CIRCLE DRAWN AROUND EACH PROPOSED INJECTION WELL. THIS CIRCLE IDENTIFIES THE WELL'S AREA OF REVIEW.

Appendix B contains a summary table (Table B-1) and a map (Figure B-1) showing the locations of all known wells within 2 miles of the proposed AGI well. The locations of all wells within the 1-mile area of review of the proposed injection well are discussed in Section 5.0 and Appendix B. Figure B-1 (Appendix B) shows all wells within one mile of the proposed AGI and Table B-2 summarizes available well data.

Lists of, and maps showing, locations of leases and data on surface owners, mineral owners, residents and other potentially interested parties within the area of review are included in Appendix C.

VI. ATTACH A TABULATION OF DATA ON ALL WELLS OF PUBLIC RECORD WITHIN THE AREA OF REVIEW WHICH PENETRATE THE PROPOSED INJECTION ZONE. SUCH DATA SHALL INCLUDE A DESCRIPTION OF EACH WELL'S TYPE, CONSTRUCTION, DATE DRILLED, LOCATION, DEPTH, RECORD OF COMPLETION, AND A SCHEMATIC OF ANY PLUGGED WELL ILLUSTRATING ALL PLUGGING DETAIL.

The tabulation of the available public data on wells within the 1-mile area of review is presented in Table B-2 and plugging diagrams for wells penetrating the San Andres within the 1-mile area of review and other associated well plugging data are provided in Appendix B.

VII. ATTACH DATA ON THE PROPOSED OPERATION, INCLUDING:

1. Proposed average and maximum daily rate and volume of fluids to be injected;
 2. Whether the system is open or closed;
 3. Proposed average and maximum injection pressure;
 4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
 5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).
-
1. Proposed injection volume is a maximum of approximately 13 MMSCFD of treated acid gas. Details of injection volumes and injection pressures are discussed in Section 3 and Table 1.
 2. The proposed injection interval in the Cherry Canyon Formation is a closed system. Additional geological data for the area of the proposed injection well is described in Section 4.0
 3. The proposed maximum injection pressure is 2,085 psi, and pressure calculations are provided in Table 1 and Section 3.2. At the depth of the proposed injection zone (6,200 to 6,530 feet), the lithostatic pressure is approximately 6,300 psi, preventing any potential for fracturing.

4. The acid gas stream is composed of approximately 95% Carbon Dioxide, 5% Hydrogen Sulfide, and traces (<1%) of methane, nitrogen and hydrocarbons. This acid gas stream will be compressed at the proposed Red Hills Gas Plant and then injected using the Red Hills AGI #1 well, located on the plant site. Representative analyses of the acid gases are included in Appendix A.
5. Formation water in the proposed zone (Cherry Canyon) was researched from available regional data. A chemical analysis of water from Federal 30 Well No. 2 (API 30-025-29069), approximately 3.9 miles away, indicates that the formation waters are highly saline (180,000 ppm NaCl). The data are included in Appendix A.

*VIII. ATTACH APPROPRIATE GEOLOGIC DATA ON THE INJECTION ZONE INCLUDING APPROPRIATE LITHOLOGIC DETAIL, GEOLOGIC NAME, THICKNESS, AND DEPTH. GIVE THE GEOLOGIC NAME, AND DEPTH TO BOTTOM OF ALL UNDERGROUND SOURCES OF DRINKING WATER (AQUIFERS CONTAINING WATERS WITH TOTAL DISSOLVED SOLIDS CONCENTRATIONS OF 10,000 MG/L OR LESS) OVERLYING THE PROPOSED INJECTION ZONE AS WELL AS ANY SUCH SOURCES KNOWN TO BE IMMEDIATELY UNDERLYING THE INJECTION INTERVAL.

The general Stratigraphy in the vicinity of the proposed well is summarized as:

Unit	From (feet)	To (feet)	Thickness (feet)
Ogalalla	0	80	80
Dockum Group	80	1,245	1,165
Rustler	1,245	1,620	375
Salado	1,620	3,530	1,910
Castile	3,530	5,190	1,660
Bell Canyon	5,190	6,202	1,012
Cherry Canyon	6,202	7,450	248
Brushy Canyon	7,450	9,005	1,555
Bone Springs	9,005	11,860	2,855
Wolfcamp	11,860	12,956	1,096
Strawn	12,956	13,330	374
Atoka	13,330	14,115	785
Morrow	14,115		

The injection target zone for the proposed well is:

Geological Name: Cherry Canyon Formation
 Lithologies: Clean sands with intervening layers of tight limestone and shale
 Thickness: Approximately 177 ft of clean sands
 Depths: 6,200 to 6,530 feet

The geometry of the overlying formations and the proposed injection zone are discussed in Section 4.0, and the regional stratigraphy is shown in Figure 6. Cross-sections of the proposed injection area are presented in Figures 10-11. In this area, the Cherry Canyon is capped by 900 ft of the Bell Canyon Formation containing numerous low-permeability limestone and shaly interbeds.

As part of our geological analysis of the site, we have researched the available net porosity for the proposed injection zone. As shown in Section 4.3, and in Figures 12-13 and Table 1, we have determined that there are approximately 15.4 feet of total net porosity (177 ft injection interval with average 18.9% porosity and S_{wr} of 0.54) in the Cherry Canyon Formation.

Based on the maximum requested injection volumes described in Section 3.1, and a conservative effective net porosity of 24 feet, we calculated that there will be a maximum use of approximately 523 acres at the maximum projected injection rate of 13 MMSCFD. Calculations are included in Section 4.4. The calculated radius of injection, after 30 years, will be approximately 2690 feet (0.51 miles) around the proposed AGI well. This area of the reservoir calculated to be affected after 30 years of injections is shown in Figure 15.

The only significant drinking water aquifers are within the shallow Ogalalla and Santa Rosa Formations (depths to approximately 650 ft). The Rustler Formation (1200-1600 ft), has total dissolved solids as low as 9000 mg/L in some areas of southeastern New Mexico, but is not being produced within ten miles of the proposed AGI well. All three of these water bearing zones will be protected by the surface and intermediate casing design of the AGI well. There are no identified wells in the one mile area of the proposed AGI well.

IX. DESCRIBE THE PROPOSED STIMULATION PROGRAM, IF ANY.

Stimulation programs, if necessary, will be evaluated following testing of the well. Some acidizing is routinely done after a workover prior to injection to clean up the hole.

*X. ATTACH APPROPRIATE LOGGING AND TEST DATA ON THE WELL. (IF WELL LOGS HAVE BEEN FILED WITH THE DIVISION, THEY NEED NOT BE RESUBMITTED).

The proposed Red Hills AGI #1 will be a new well; there are no existing well logs or test data for the well. All geophysical logs were examined for wells within three miles of the proposed well. This data was used to characterize the surface structure and injectivity of the proposed injection interval (see Section 4.4 and Figures 10-13). Open hole logs will be collected during drilling of the well and submitted to NMOCD prior to commencing injection.

*XI. ATTACH A CHEMICAL ANALYSIS OF FRESH WATER FROM TWO OR MORE FRESH WATER WELLS (IF AVAILABLE AND PRODUCING) WITHIN ONE MILE OF ANY INJECTION OR DISPOSAL WELL SHOWING LOCATION OF WELLS AND DATES SAMPLES WERE TAKEN.

No fresh water wells were identified within one mile of the proposed AGI. The closest freshwater well listed by the State Engineers Office is located approximately 1.4 miles away.

XII. APPLICANTS FOR DISPOSAL WELLS MUST MAKE AN AFFIRMATIVE STATEMENT THAT THEY HAVE EXAMINED AVAILABLE GEOLOGIC AND ENGINEERING DATA AND FIND NO EVIDENCE OF OPEN FAULTS OR ANY OTHER HYDROLOGIC CONNECTION BETWEEN THE DISPOSAL ZONE AND ANY UNDERGROUND SOURCES OF DRINKING WATER.

We have analyzed the available geological and engineering data and affirm that there are no open faults or other hydrogeological connections between the proposed injection zone(s) and the known sources of drinking water (see Sections 4.0 and 5.0).

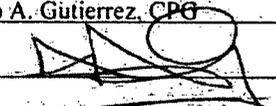
XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.

Notices are being prepared for adjacent operators, surface owners and tenants, and a public notice for interested parties will be published in Lea County, New Mexico. Copies of draft notices and the draft legal notice are provided in Appendix C. Return Receipt from notices and copies of the publication affidavit will be submitted at the hearing.

XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: Alberto A. Gutierrez, CPG

TITLE: Consultant to Agave Energy Company

SIGNATURE: 

DATE: 7/20/2011

E-MAIL ADDRESS: aa@geolex.com

* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal: _____

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

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- Appendix B: Active Oil and Gas Well Data; Permanently Plugged Oil and Gas Well Data
- Appendix C: Operators, Lessees and Surface Owners in Area of Review; Applicable Notices Including: Proposed Notice to Operators and Leaseholders; Proposed Notice to Surface Owners; and Proposed Public Notice

1.0 EXECUTIVE SUMMARY

On behalf of Agave Energy Company (Agave), Geolex[®], Inc. (Geolex) has prepared and is hereby submitting a complete C-108 application for approval to drill, complete and operate a combined acid gas injection and CO₂ sequestration well at the proposed Agave Red Hills Gas Plant in Section 13, T24S, R33E approximately 20 miles west/northwest of Jal in Lea County, New Mexico (Figure 1).

The proposed Agave Red Hills AGI #1 well is anticipated to have a total depth of approximately 6,550 feet in the Cherry Canyon Formation of the Delaware Basin (Permian). The proposed injection zone will be within five porous sandstone units of the upper Cherry Canyon, lying between approximate depths of 6,200 to 6,530 feet. Analysis of the reservoir characteristics of these units confirms that they act as excellent closed-system reservoirs that should easily accommodate the future needs of Agave for disposal of acid gas and sequestration of CO₂ from the proposed Red Hills Plant. Agave needs to safely inject up to 13 million standard cubic feet per day (MMSCFD) of treated acid gas (TAG) for 30 years. Geologic studies conducted for the selection of this location demonstrate that the proposed injection zone is readily capable of accepting and containing the proposed acid gas and CO₂ injection volumes well within NMOCD's recommended maximum injection pressures.

In preparing this C-108 application, Geolex conducted a detailed examination of all of the elements required to be evaluated in order to prepare and obtain approval for this application for injection. The elements of this evaluation included:

- Identification and characterization of all hydrocarbon-producing zones of wells that surround and are present on the proposed plant site;
- The depths of perforated pay intervals in those wells relative to the depth of the target injection zones (Cherry Canyon);
- The past and current uses of the proposed injection interval;
- Total feet of net porosity in the proposed Cherry Canyon injection interval;
- The stratigraphic and structural setting of the targeted zones relative to any nearby active or plugged wells, and other wells penetrating the intervals;
- The identification of and sample notification letter that will be sent to all surface owners within a one-mile radius of the proposed injection well;
- The identification of all wells within a two-mile radius and of all operators, lessees and surface owners within a one-mile area of review of the proposed injection well;
- Identification and characterization of all plugged wells within the one-mile area of review of the proposed injection well;
- The details of the proposed injection operation, including general well design and average and maximum daily rates of injection and injection pressures;
- Sources and predicted composition of injection fluid and compatibility with the formation fluid of the injection zone
- Location and identification of any fresh water bearing zones in the area; the depth and quality of available groundwater in the vicinity of the proposed well, including a determination that there are no structures which could possibly communicate the disposal zone with any known sources of drinking water;
- Since the final design and construction of the Red Hills Gas Plant is contingent on successful permitting of the proposed AGI well, no Rule 11 Plan has yet been prepared for the facility. Once approval has been granted for the AGI well, the plant design will be finalized and a Rule 11 Plan will be prepared following the model of the Agave Dagger Draw Gas Plant and Metropolis Disposal #1. The Rule 11 Plan will be submitted for NMOCD review and approval prior to commencement of TAG injection into the Agave Red Hills AGI #1 well.

Based upon this detailed evaluation, as summarized in this application, Agave has determined that the proposed injection well is a safe and environmentally-sound project for the disposal of acid gas. Furthermore, the project provides additional environmental benefit by permanently sequestering a significant volume of CO₂ which would otherwise be released to the atmosphere if H₂S was flared or if a sulfur reduction unit (SRU) was operated at the Plant.

Our research has identified five sandstone units in the Cherry Canyon Formation, located approximately 6,200 to 6,530 feet below the plant. These units are effectively sealed above and below by the much less permeable adjacent facies within the overlying Bell Canyon and the underlying Brushy Canyon.

At the anticipated reservoir conditions of 112° F and 2,600 psi, each million standard cubic feet of TAG will occupy a volume of 2,458 cubic feet (438 barrels).

Only six wells are listed within one mile of the proposed AGI, of which one is active and five are plugged. The active well penetrates the Cherry Canyon, and is completed in the Bone Springs Formation (top of formation around 9,100 feet). Four of the five plugged wells penetrate the Cherry Canyon. A review of the plugging reports indicates that the injection zone is properly isolated by all of the plugged wells within one mile of the proposed AGI (see plugged and active well information included in Appendix B).

Conoco Phillips and the Kaiser & Francis Oil Company jointly hold the active oil and gas leases for the entire one-mile area. The surface in this area is owned largely by private parties (the Robert Madera Trust, Billie McKandles Fortner, Mark T. McCloy, Agave Energy, and the Southwestern Public Service Company), with a small portion owned by the United States of America (Bureau of Land Management). All surface owners and operators within a one-mile radius of the proposed injection well will be notified at least 20 days prior to the NMOCC hearing pursuant to the requirements of NMOCC. Details on all lessees and surface owners are included in Appendix C.

There is no permanent body of surface water within several miles of the plant. A search of the New Mexico State Engineer's files shows no water wells lie within one mile of the proposed AGI. Available information shows that groundwater occurs at a depth of approximately 20-650 feet, and is hosted by the Ogallala and Santa Rosa Formations. Groundwater from the Rustler formation (1,245 to 1,600 ft depth) has total dissolved solids generally exceeding 9,000 mg/L in some parts of southeastern New Mexico (Lambert, 1992).

2.0 INTRODUCTION AND ORGANIZATION OF THIS C-108 APPLICATION

The completed NMOCD Form C-108 is included before the Table of Contents of this document and references appropriate sections where data required to be submitted are included herein.

This application organizes and details all of the information required by NMOCD and NMOCC to evaluate and approve the submitted Form C-108 – Application for Authorization to Inject. This information is presented in the following categories:

- A detailed description of the location, construction and operation of the proposed injection well (Section 3.0)
- A summary of the regional and local geology, the hydrogeology, and the location of drinking water wells within the area of review (Section 4.0)
- The identification, location, status, production zones, and other relevant information on oil and gas wells within the area of review (Section 5.0)
- The identification and required notification for operators and surface land owners that are located within the area of review (Section 6.0)
- An affirmative statement, based on the analysis of geological conditions at the site, that there is no hydraulic connection between the proposed injection zone and any known sources of drinking water (Section 7.0), and

In addition, this application includes the following supporting information:

- Appendix A: Injection fluid analysis; Cherry Canyon reservoir conditions and fluid analysis.
- Appendix B: Maps and spreadsheets showing all active, temporarily abandoned, abandoned and plugged oil and gas wells included within two miles, and the one-mile area of review and associated plugging reports.
- Appendix C: Maps and spreadsheets showing operators, lessees, and surface owners in the one-mile radius area of review; copy of the notification letter that will be sent out to them at least 20 days prior to the NMOCD hearing; and a draft public notice of the hearing.

It is anticipated that this application shall be the subject of a NMOCD hearing on July 21, 2011.

3.0 PROPOSED CONSTRUCTION AND OPERATION OF AGAVE AGI WELL

The proposed injection well will be drilled on the Red Hills Plant Site in Unit I, Section 13, T24S, R33E at approximately 150 FEL, 1,600 FSL. Figure 2 is a general plot plan of the proposed Red Hills Gas Plant that shows the proposed location of the new well and compression facilities relative to proposed features at the site. The proposed surface location is owned by Agave.

3.1 CALCULATED MAXIMUM INJECTION PRESSURE

The well will be designed and constructed such that it will serve as the injection conduit for a mixed stream of treated acid gas. The treated acid gas stream (TAG) will be approximately of the following composition:

- 95% CO₂
- 5% H₂S
- Trace Components of C₁ – C₆ and Nitrogen

The total volume of TAG to be injected daily will be approximately 13 MMSCFD. Pressure reduction valves will be incorporated to assure that maximum surface injection pressure allowed by NMOCD will not be exceeded.

The specific gravity of TAG is dependent on the temperature and pressure conditions and the composition of the fluid mixture. It is most accurately calculated using a modification of the Peng-Robinson (PR) equation of state (EOS) model (Boyle and Carroll, 2002). We have calculated the specific gravity of the supercritical TAG phase for the proposed Red Hills injection stream using the AQUAlibrium 3.1 software which employs the modified PR EOS model (Table 1). We have modeled the proposed maximum daily injection 13 MMSCF TAG composed of 95 mol % CO₂ and 5 mol % H₂S. Specific gravities of TAG were determined for the conditions at the well head (pressure = 1,200 psi, temperature = 100°F) and the bottom of the well (pressure = 2,600 psi, temperature = 100°F). The specific gravity of TAG at equilibrium with the reservoir (pressure = 2,600 psi, temperature = 112°F; Appendix A) was also determined to evaluate the area expected to be affected by injection in the reservoir (see Section 4.4).

The calculated maximum allowable injection pressure would be approximately 2,085 psi (depending on specific gravity of final TAG stream). We have used the following method approved by NMOCD to calculate the preliminary proposed maximum injection pressure. The final maximum permitted surface injection pressure should be based on the final specific gravity of the injection stream according to the following formula:

$$IP_{\max} = PG (D_{\text{top}}) \quad \text{where:} \quad \begin{array}{l} IP_{\max} = \text{maximum surface injection pressure (psi)} \\ PG = \text{pressure gradient of injection fluid (psi/ft)} \\ D_{\text{top}} = \text{depth at top of perforated interval of injection zone (ft)} \end{array}$$

and $PG = 0.2 + 0.433 (1.04 - SG_{\text{tag}})$ where: $SG_{\text{tag}} = \text{average specific gravity of treated acid gas in the tubing (} SG_{\text{tag}} \text{ at top} = 0.61 \text{ and } SG_{\text{tag}} \text{ at bottom hole} = 0.84; \text{ see Table 1)}$

For the maximum requested injection volume, case it is assumed that:

$$\begin{array}{l} SG_{\text{tag}} = 0.73 \\ D_{\text{top}} = 6200 \text{ ft} \end{array}$$

Therefore:

$$\begin{array}{l} PG = 0.2 + 0.433 (1.04 - 0.73) = 0.336 \text{ psi/ft} \\ IP_{\max} = PG (D_{\text{top}}) = 0.336 * 6200 = 2085 \text{ psi} \end{array}$$

Table 1: Pressure and Volume Calculations for TAG, Red Hills

PROPOSED INJECTION STREAM CHARACTERISTICS

TAG	H ₂ S conc. mol %	CO ₂ conc. mol %	H ₂ S inject rate lb/day	CO ₂ inject rate lb/day	TAG inject rate lb/day
13	5	95	61700	1513818	1575517

CONDITIONS AT WELL HEAD

Well Head Conditions		TAG							
Temp F	Pressure psi	Gas vol MMSCFD	Comp CO ₂ :H ₂ S	Inject Rate lb/day	Density ¹ kg/m ³	SG ²	density lb/gal	volume ft ³	volume bbl
100	1400	13	95:5	1575517	611.85	0.61	5.11	41228	7343

CONDITIONS AT BOTTOM OF WELL

Injection Zone Conditions		TAG							
Temp F	Pressure ³ psi	Depth _{top} ft	Depth _{bottom} ft	Thickness ⁴ ft	Density ¹ kg/m ³	SG ²	density lb/gal	volume ft ³	volume bbl
100	2600	6200	6530	177	839.00	0.84	7.01	30066	5355

CONDITIONS IN RESERVOIR AT EQUILIBRIUM

Injection Reservoir Conditions		TAG							
Temp ⁵ F	Pressure ³ psi	Ave. Porosity %	S _{wr} ⁷	Porosity ft	Density ¹ kg/m ³	SG ²	density lb/gal	volume ft ³	volume bbl
112	2600	18.9	0.541	15.4	789.34	0.79	6.59	31957	5692

CONSTANTS

Molar volume at STD	SCF/mol	0.7915
Molar weight of H ₂ S	g/mol	34.0809
Molar weight of CO ₂	g/mol	44.0096
Molar weight of H ₂ O	g/mol	18.015

¹ Density calculated using AQUAlibrium software

² Specific gravity calculated assuming a constant density for water

³ PP is extrapolated using successful Drill Stem Tests at nearby wells; Appendix A

⁴ Thickness is the average total thickness of coarse sand units in the reservoir zone

⁵ Reservoir temp. is extrapolated temps. measured at nearby wells; Appendix A

⁶ Porosity is estimated using geophysical logs from nearby wells

⁷ CALCULATION OF IRREDUCIBLE WATER (using Archie Equation with values for "average" sands)

$$a = 1.45 \quad R_w = 0.031$$

$$n = 1.54 \quad R_t = 2$$

$$F = a/\phi_{ave}^n = 18.863$$

$$S_{wr} = (F * R_w / R_t)^{1/2} = 0.541$$

CALCULATION OF MAXIMUM INJECTION PRESSURE LIMITATION

$$SG_{TAG} = 0.73$$

$$PG = 0.2 + 0.433 (1.04 - SG_{TAG}) = 0.336 \text{ psi/ft}$$

$$IP_{max} = PG * \text{Depth} = 0.336 * 6200 = 2085 \text{ psi}$$

Where: SG_{TAG} is specific gravity of TAG; PG is calculated pressure gradient; and IP_{max} is calculated maximum injection pressure.

CALCULATION OF 30 YEAR AREA OF INJECTION

$$\text{Cubic Feet/day (5.6146 ft}^3/\text{bbl)} = 31957 \text{ ft}^3/\text{day}$$

$$\text{Cubic Feet/30 years} = 350171549 \text{ ft}^3/\text{30 years}$$

$$\text{Area} = V/\text{Net Porosity (ft)} = 22791369 \text{ ft}^2/\text{30 years}$$

$$\text{Area} = V/\text{Net Porosity (ft)} (43560 \text{ ft}^2/\text{aci}) = 523.2 \text{ acres/30 year:}$$

$$\text{Radius} = 2693 \text{ ft}$$

$$\text{Radius} = 0.51 \text{ miles}$$

Where: a is porosity intercept, n is cementation exponent, F is formation factor, R_w is formation water resistivity, and R_t is observed bulk resistivity

It is anticipated that the average injection pressure would not exceed 1,900 psi. Based on the above calculations, Agave is requesting approval of a maximum injection pressure to be 2,085 psi at the surface.

3.2 WELL DESIGN

The AGI facilities and well are integrated components of the proposed Red Hills Gas Plant design (Figure 2). The schematic of the AGI facilities and tie-in to the proposed Red Hills Gas Plant are shown in Figure 3, and the preliminary well design for the injection well is shown on Figure 4. The final design for the compression facilities and associated piping and layout of H₂S alarms and other safety equipment will be submitted for NMOCD review prior to commencement of injection operations as part of a complete Rule 11 Plan.

The proposed well (Agave Red Hills AGI #1) will be a vertical well, spudded on Agave's Red Hills Gas Plant site and drilled to a final total depth of approximately 6,550 feet. The well will have each string of the telescoping casing cemented to the surface and will include a subsurface safety valve on the production tubing to assure that fluid cannot flow back out of the well in the event of a failure of the injection equipment. In addition, the annular space between the projection tubing and the well bore will be filled with an inert fluid (diesel fuel) as a further safety measure which is consistent with injection well designs which have been previously approved by NMOCD for acid gas injection.

Design and materials considerations include: placement of SSSV and the packer, double casing through freshwater resources (Ogallala and Santa Rosa Formations – groundwater, Rustler – saline groundwater), characterization of the zone of injection, and a total depth (TD) ensuring identification of the reservoir. Three casing strings are proposed (Figure 4):

1. Surface casing to the top of the Rustler anhydrite, approximately 1,245 feet depth, to protect fresh water in the Ogallala and Santa Rosa Formations.
2. Intermediate casing to the base of the Salado and Castile Formations, approximately 5,190 feet, to protect the brackish aquifer in the Rustler Formation.
3. Production casing extending down to the final total depth (TVD 6,550 feet). Following logging and analysis, the injection intervals will be determined, and the final depth of the long string, perforation zones and packer location will be selected.

A suitable drilling rig will be chosen for the job that will include a 4,000 psi blowout preventer (minimum) and choke manifold for any unforeseen pressures encountered. The borehole for the surface casing will be drilled with a 17 ½-inch bit to a depth of approximately 1,245 feet, and 13 ¾-inch, 48.0 ppf, H40, STC casing will be installed and cemented to the surface with approximately 600 sacks of cement (or amount adequate to circulate the cement to the surface). The intermediate hole will be drilled with a 12 ¼-inch bit to a depth of approximately 5,190 feet. There an 9 ⅝-inch, 40.0 ppf, J55, STC surface casing string will be run and cemented to surface with approximately 1,500 sacks of cement. Visual inspections of cement returns to the surface will be noted in both the conductor and surface pipe casing jobs. Casing and cement integrity will be demonstrated by pressure-testing after each cement job.

After verifying the intermediate casing, the well will be drilled to the projected TVD of 6,550 feet using an 8 ¾-inch bit.

The proposed open hole logging suite for the TD run consists of a Dual Induction, Density-Neutron-Gamma Ray Porosity and Fracture Matrix Identification (FMI) log in the Bell Canyon and the Cherry Canyon. A conventional core will be collected from the tight zone near the base of the Bell Canyon into

the upper Cherry Canyon target reservoir sands. Representative core samples will be analyzed in the laboratory to determine caprock and reservoir permeabilities and porosity.

After the logs have been evaluated, the production casing consisting of approximately 6550 feet of 7-inch, 26.0 ppf, L80 casing grade will be run and cemented with approximate total of 1,500 sacks of cement. A 30-foot section of Corrosion Resistant Alloy (CRA) material will be inserted into the string at the packer setting depth to provide a corrosion resistant seat for the packer later in the job. The cementing of the long string will be accomplished in two stages. The first stage will seal the annular space from total depth (approximately 6,550 feet) to a level well above the CRA joint. This stage will employ acid-resistant cement (CORROSACEM™ or equivalent). For the second stage, a DV Tool previously inserted in the casing (at approximately 3,000) feet will be used to pump the remaining cement to the surface.

Once the cement has set up, the tubing adaptor for the wellhead will be welded on the wellhead and the rig will be released. A casing integrity (pressure test) will be performed to test the casing just prior to releasing the rig. After a successful test and the drilling rig released, a work-over rig will be mobilized to location and a cement bond log will be run to ascertain the quality of the cement bond of the production casing. It is important that a good bond be established around the injection interval as well as below the CRA joint to minimize any chances that acid gases mixed with formation water do not travel up the outside of the casing and negatively impact the integrity of the casing job.

Once the integrity of the cement job has been determined, the selected injection intervals will be perforated with approximately four shots per foot. At this location a total of approximately 175 feet of target areas may be perforated. A temporary string of removable packer and tubing will be run, and injection tests (step tests) will be performed to determine the final injection pressures and volumes. Once the reservoirs have been tested, the final tubing string including a permanent packer, approximately 6,550 feet of 3 ½-inch 9.3 ppf, L80 ULTRA FX premium thread tubing, and a Subsurface Safety Valve (SSV) will be run into the well. A ¼-inch stainless steel line will connect the SSV to a hydraulic panel at the surface.

The National Association of Corrosion Engineers (NACE) issues guidelines for metals exposed to various corrosive gases like the ones in this well. For a H₂S/CO₂ stream of acid gas that is de-watered at the surface through successive stages of compression, downhole components such as the SSV, (subsurface safety valve), and packer need to be constructed of Inconel 925. The CRA joint will be constructed of a similar alloy from a manufacturer such as Sumitomo. A product like SM2550 (with 50% nickel content) will likely be used. The gates, bonnets and valve stems within the Christmas tree will be nickel coated as well.

The rest of the Christmas tree will be made of standard carbon steel components and outfitted with annular pressure gauges that report operating pressure conditions in real time to a gas control center located remotely from the wellhead. In the case of abnormal pressures or any other situation requiring immediate action, the acid gas injection process can be stopped at the compressor and the wellhead shut-in using a hydraulically operated wing valve on the Christmas tree. The SSV provides a redundant safety feature to shut in the well in case the wing valve does not close properly.

After the AGI well is drilled and tested to assure that it will be able to accept the volume of injection fluid (without using acid gas), it will be completed with the approved injection equipment for the acid gas stream.

Since the Red Hills Gas Plant has not yet been constructed, no Rule 11 Plan has yet been prepared. Once approval has been granted for this AGI well, the plant design will be finalized and construction undertaken. A Rule 11 Plan will be prepared following the model of the Agave Dagger Draw Gas Plant

and Metropolis Disposal #1 and submitted for NMOCD review and approval prior to commencement of TAG injection into the Agave Red Hills AGI #1 well.

4.0 REGIONAL AND LOCAL GEOLOGY AND HYDROGEOLOGY

4.1 GENERAL GEOLOGIC SETTING

The proposed Red Hills Gas Plant will be located in the southern half of Section 13, T 24 S, R 33 E, in Lea County, New Mexico, about 20 miles west northwest of Jal (Figure 1). The plant location is within a portion of the Pecos River basin referred to as the Antelope Ridge Area (Nicholson & Clebsch, 1961). This area is relatively flat and largely covered by sand dunes underlain by a hard caliche surface. The dune sands are locally stabilized with shin oak, mesquite and some bur-grass. There are no surface bodies of water or groundwater discharge sites within one mile of the Plant and where drainages exist in interdunal areas, they are ephemeral, discontinuous, dry washes. Two notable playa lakes, including Bell Lake, are found in the vicinity. The proposed plant site is underlain by Quaternary alluvium and the Pliocene Ogallala Formation that hosts an important local freshwater aquifer. Beneath these lie Triassic redbeds of the Santa Rosa Formation (Dockum Group), another local source of groundwater. The thick sequence of Permian rocks that underlie these deposits are described generally below.

4.2 BEDROCK GEOLOGY

The well is located in the Delaware Basin, a sub-basin of the larger, encompassing Permian Basin (Figure 5). The Delaware Basin began to form by the Middle Mississippian, and was subsequently deepened by deformation during the Hercynian orogeny of the Pennsylvanian through Early Permian. Following the orogeny, the Delaware Basin was structurally stable and gradually was filled by large quantities of clastic sediments while carbonates were deposited on the surrounding shelves.

The Permian rocks found in the Delaware Basin are divided into four series, the Ochoa (most recent), Guadalupe, Leonard, and Wolfcamp (oldest). Numerous oil and gas pools have been identified in these rocks. In the area of the proposed Red Hills well, the rocks consist predominately of clastic rocks – primarily sands, and shales with lesser carbonates. Producing reservoirs are concentrated in the high porosity sands. Figure 6 is a generalized stratigraphic column showing the formations that underlie the well site. Local oil production is largely restricted to the Delaware Sands pool, and gas production is dispersed through the Bone Springs (the “Avalon”), Wolfcamp, and Morrow, with smaller amounts from the Atoka and Devonian (Figure 7). There have been no commercially significant deposits of oil or gas found in Cherry Canyon, the proposed injection zone, or in the vicinity of the well. The injection zone was tested wet at a well 2.77 miles away, and there is no current or foreseeable production at these depths within the one-mile radius of review mandated by the NMOCD for AGI permitting (C-108).

4.3 LITHOLOGIC AND RESERVOIR CHARACTERISTICS OF THE CHERRY CANYON FORMATION

Based on the geologic analyses of the subsurface at the proposed Red Hills Gas Plant, we recommend acid gas injection and CO₂ sequestration in the uppermost Cherry Canyon Formation. The proposed injection interval includes five high porosity sandstone units and has excellent caps above, below and between the individual sandstone units. There is no local production in the overlying Delaware Sands pool of Bell Canyon Formation (Figure 9). There are no structural features or faults that would serve as potential vertical conduits. The high net porosity of the proposed injection zone indicates that the injected H₂S and CO₂ will be easily contained close to the injection well.

The geophysical logs were examined for all wells penetrating the Cherry Canyon Formation within a three-mile radius of the proposed Agave Red Hills AGI #1 well. Using the formation tops from more than 70 wells, a contour map was constructed for the top of the Cherry Canyon Formation (Figure 8) in the vicinity of the well. This map reveals an approximate 1.0° dip to the south, with no visible faulting or

offsets that might influence fluid migration, suggesting that injected fluid would spread radially from the point of injection with a small elliptical component to the south. This interpretation is supported by cross-sections of the overlying stratigraphy that reveal relatively horizontal contacts between the units (Figures 9-10). Local heterogeneities in permeability and porosity will exercise significant control over fluid migration and the overall three-dimensional shape of the injected gas plume.

A geological analysis confirms that the upper Cherry Canyon Formation as the most promising injection zone in the vicinity of the proposed Agave Red Hills AGI #1 well. This preliminary analysis is confirmed by Geolex's detailed geological analysis, including the analysis of the geophysical logs collected from nearby wells. The zone has the requisite high porosity and permeability and is bounded by tight limestones, shales, and calcic siltstones rocks in the Bell Canyon above and the lower Cherry Canyon and Brushy Canyon below. These are ideal H₂S and CO₂ sequestration conditions.

Ochoa Series. The youngest of the Permian sediments are referred to as the Ochoa Series. These sediments were deposited in arid to semi-arid conditions, near the shore of the sea filling the Delaware Basin. Red beds of terrigenous sands in the Rustler Formation resulted from Eolian sediment transport. These red beds grade downwards into evaporates of the Salado and Castile Formations that were deposited in supra and intertidal flats.

Guadalupe Series. Sediments in the underlying Guadalupe Series are marine and were deposited within the basin at depths that varied due to numerous changes in sea-level. The sediments are predominately quartz-rich and terrigenous in origin. The quartz-rich sands are fine grained and poorly cemented. They have been interpreted to be channel deposits, resulting from density currents carrying sediments of the shelf through submarine canyons. The sandstones are interspersed with fine-grained rocks and limestones that taper with distance from the shelf. The limestones consist of laminated micrites and result from the transport of carbonate from the shelf in suspension. Limited amounts of coarse carbonate detritus have been attributed to density currents from shallow water on the shelf. The top of the Guadalupe Series is locally marked by the Lamar Limestone, which is the source of hydrocarbons found directly beneath it in the Delaware Sand (an upper member of the Bell Canyon Formation). The Bell Canyon, Cherry Canyon, and lowermost Brushy Canyon are all characterized by alternating units of channel sands with limestones and fine-grained sediments. The Cherry Canyon has notably more discrete units than the Brushy Canyon. The relatively fine-grained sands coarsen towards the base of the Brushy Canyon.

Leonard Series. The Leonard Series, located beneath the Guadalupe Series sediments, is characterized by basal sediments similar to the Guadalupe. Locally, the Leonard Series consists exclusively of the Bone Springs Formation. The Bone Springs has less terrigenous material (sands) and more carbonates than the Guadalupe Series. The several, well defined sand units were deposited by sediments transported by density currents through submarine canyons. These sand units are associated with periods of high sea levels, while the thick intervening carbonate units are associated with lower sea levels.

The porosity of the units in the area were evaluated using geophysical logs collected from nearby wells penetrating the Cherry Canyon Formation. Figure 12 shows the Resistivity (Res) and Thermal Neutron Porosity (TNPH) logs from 5,050 feet to 6,650 feet and includes the proposed injection interval. Five clean sands (>10% porosity and <60 API gamma units) separated by limestone beds mapable units demonstrating lateral continuity of units. The sand units exhibit an average porosity of about 18.9%; taken over the average thickness of the clean sand units within ½ mile of the proposed Agave Red Hills AGI #1 of 177 feet (Figure 13) and irreducible water (S_{wir}) of 0.54 (see Table 1). This results in an effective porosity of approximately 15.4 feet after considering S_{wir}. The overlying Bell Canyon Formation has 900 feet of sands and intervening tight limestones, shales, and calcitic siltstones with porosities as low as 4%, consistent with an effective seal on the injection zone. The proposed injection

interval is located more than 2,650 feet above the Bone Spring Formation (Avalon zone), which is the next possible pay in the area.

4.4 INJECTIVITY OF THE CHERRY CANYON FORMATION

No direct measurements have been made of the injection zone porosity or permeability. However, satisfactory injectivity of the injection zone can be inferred from the porosity logs described above. The good injectivity of the zone is supported by the performance of nearby SWD wells. Four SWD wells are located within a 7.5-mile radius, injecting into the same zone; the closest is about 2.0 miles away (Vaca Ridge 30 Federal 001; Figure 14). The Vaca Ridge 30 Federal 001 has been injecting since 1994 on vacuum (no recorded injection pressure) at rates of up to 5,000 bbl/day.

A maximum allowable surface injection pressure was calculated for the proposed AGI well following the NMOCD approved formula: $IP_{max} = PG (D_{top})$, where IP_{max} is the maximum allowed surface injection pressure (psi), PG is the pressure gradient of the injected fluid (psi/ft), and D_{top} is the depth to the top of the perforated zone (ft). Using the proposed depth to the perforated zone in the Red Hill AGI #1 well (6,230 ft) and TAG as the injection fluid, the maximum allowable injection pressure would be approximately 2,085 psi (Table 1). This value is significantly higher than the maximum allowable injection pressure for saltwater (approximately 1,240 psig), due to the lower specific gravity of TAG.

The reservoir pressure and temperature have been estimated by plotting data from nearby wells. A plot of bottomhole temperatures (Figure A1) reveals a consistent trend with depth, indicating that the reservoir temperature in the proposed well would be approximately 112° F. A plot of reservoir pressures using successful Drill Stem Tests (DSTs) show some scatter, but indicates that the reservoir pressure in the proposed well would be about 1,600 psi.

Using the total porosity determined from well logs, combined with an allowance for S_{wir} of 0.54 (Table 1), it is possible to estimate the area of injection over a 30-year life span for an AGI well at the proposed Red Hills Gas Plant. Assuming a maximum injection rate of 13 MMSCFD (7,343 bbl/day of compressed TAG at well head conditions equates to approximately 5,692 bbl/day at reservoir conditions, see Table 1), acid gas would spread to cover an area of approximately 532 acres or a circle with a radius of approximately 0.51 miles (Figure 15 and Table 1). This maximum injection rate is roughly equivalent with the Vaca Ridge 30 Federal 001 injecting into the same zone two miles away.

Table 2: Calculations of Area and Volume of Reservoir Affected by Proposed Injection	
	Maximum Injection Rate – 13 MMSCFD of TAG
Barrels per Day at Reservoir Conditions	5,692
Cubic Feet/Day (5.6146 Cubic Feet per Barrel)	31,957
Cubic Feet/ Year (365.25 Days)	11,672,385
Cubic Feet in 30 Years	350,171,549
Effective Porosity in Feet = 15.4 feet	
Net Area Consumed (Volume/eff. porosity) (ft)	22,791,369
Net Area in Acres (43,560 Sq. feet/acre)	523
Radius in feet	2,693
Radius in miles	0.51

4.5 FORMATION FLUID CHEMISTRY

There are four SWD wells injecting into the Cherry Canyon Formation within a 10-mile radius of the proposed Agave Red Hills AGI #1, the proposed injection zone (Table 3). The closest of these wells is located approximately 2.0 miles from the Agave Red Hills AGI #1. A chemical analysis of water from Federal 30 Well No. 2 (API 30-025-29069), approximately 3.9 miles away, indicates that the formation waters are highly saline (180,000 ppm NaCl) and compatible with the proposed injection (see Appendix A).

Table 3. Salt Water Disposal Wells Injecting Into the Delaware Group Within 10 Miles of the Proposed Red Hills AGI #1.

API	OPERATOR	SPUD	TD	WELL NAME	DIST	TOP	BOT	ZONE
3002528873	EOG RESOURCES INC	9/12/84	15505	VACA RIDGE 30 FEDERAL 001	1.97	5424	6360	CHERRY CANYON
3002524916	CHESAPEAKE OPER, INC.		14238	ANTELOPE RIDGE UNIT 005	3.84	5167	6134	BELL CANYON
3002508489	KAISER-FRANCIS OIL CO		13044	BELL LAKE UNIT 002	3.84	5185	7060	BELL/CHERRY CANYON
3002524676	ENDURANCE RES LLC	2/14/74	8710	FEDERAL 19 001	5.64	6670	6883	CHERRY CANYON
3002524003	SIANA OPERATING LLC	12/28/71	13500	CURRY FEDERAL 002	5.88	5240	6160	BELL CANYON
3002524432	PRIMAL ENERGY CORP	6/7/73	5204	INGRAM O STATE 002	5.99	5012	5033	BELL CANYON
3002524771	CONOCO INC	1/2/00	13589	BELL LAKE UNIT 4 015	7.21	5060	6520	BELL/CHERRY CANYON

4.6 GROUNDWATER HYDROLOGY IN THE VICINITY OF THE PROPOSED INJECTION WELL

Based on the New Mexico Water Rights Database from the New Mexico Office of the State Engineer, there are no freshwater wells located within a one mile radius of the Agave Red Hills AGI #1 well; the closest water well is located 1.37 miles away (Figure 16; Table 4). All wells within a five mile radius are shallow, collecting water from about 20 to 650 feet depth. The wells were drilled primarily for stock and commercial purposes; there are two domestic water wells within five miles of the proposed Agave Red Hills AGI #1. The shallow freshwater aquifer is protected by the surface and intermediate casing in the proposed Agave Red Hills AGI #1 well, which extend to 1,245 feet and 5,190 feet, respectively.

The area surrounding the proposed injection wells is arid and there are no bodies of surface water within a five mile radius.

Table 4: Water Wells Within Five Miles of Proposed Red Hills AGI #1

POD Number	Use	County	Source	q64	q16	q4	Sec	Tws	Rng	*	Dist (miles)	Depth Well (feet)	Depth Water (feet)
C 02309	STK	LEA	Shallow	2	2	2	25	24S	33E	*	1.37	60	30
C 02373	PRO	LEA	Shallow		4	1	32	24S	34E	*	3.02	600	n/a
C 02581	PRO	LEA	Shallow		4	4	31	23S	34E		3.04	n/a	n/a
C 02308	STK	LEA	Shallow	1	3	1	10	24S	33E	*	3.22	40	20
C 02386	DOM	LEA	Shallow	4	1	2	04	24S	34E	*	3.69	575	475
C 02397	COM	LEA	Shallow	4	1	2	04	24S	34E	*	3.69	575	475
C 02430	COM	LEA	Shallow	3	3	3	16	24S	33E	*	3.92	643	415
C 02564	COM	LEA	Shallow	2	4	2	33	24S	33E	*	4.01	120	n/a
C 02431	COM	LEA	Shallow	4	4	4	17	24S	33E	*	4.04	525	415
C 02432	COM	LEA	Shallow	4	4	4	17	24S	33E	*	4.04	640	415
C 02563	COM	LEA	Shallow	1	4	2	33	24S	33E	*	4.10	120	n/a
C 02284	STK	LEA	Shallow	4	2	4	26	23S	33E	*	4.14	325	225
C 02310	COM	LEA	Shallow	2	3	2	33	24S	33E	*	4.20	120	70
C 02311	DOM	LEA	Shallow	2	3	2	33	24S	33E	*	4.20	120	70
C 02387	STK	LEA	Shallow			1	11	24S	34E	*	4.51	62	40
C 02890	STK	LEA	Shallow		2	4	29	24S	33E	*	4.53	500	n/a
C 02282	STK	LEA	Shallow	3	1	1	25	23S	33E	*	4.60	325	225
C 02283	STK	LEA	Shallow	4	2	2	26	23S	33E	*	4.63	325	225
C 02281	COM	LEA	Shallow	3	4	4	28	23S	33E	*	4.92	545	400

5.0 OIL AND GAS WELLS IN THE AGAVE RED HILLS AGI AREA OF REVIEW AND VICINITY

Appendix B contains a complete list based on NMOCD records of all active, temporarily abandoned, abandoned and plugged oil and gas wells within two miles and those within the one-mile radius area of review (Figure B-1, Table B-1) of the proposed AGI disposal well.

There are 18 recorded wells within two miles of the Plant (Appendix B, Figure B-1), of which five are active, one is zone plugged (temporarily abandoned), and 12 are listed as plugged and abandoned. Within the one-mile area of review for the proposed well, there are six wells, of which one is active and five are plugged and abandoned. These wells are shown in Table 5 and Appendix B, Figure B-2.

As shown in the Table 5 below, and in the accompanying Figure B-1 in Appendix B, there are a total of five wells penetrating the Cherry Canyon ("deep wells") in the one mile area of review, one active and four plugged and abandoned. A review of the available data indicates that the one active well (Madera Ridge 24 001) is cased and cemented throughout the Cherry Canyon interval, and that the abandoned wells are properly plugged and effectively seal the Cherry Canyon formation, preventing any migration of injected fluids to deeper or shallower units (see plugging and completion diagrams in Appendix B).

Table 5: Summary of Wells Penetrating Cherry Canyon within One Mile of Proposed Red Hills Gas Plant

API #	OPERATOR	SPUD DATE	PLUG DATE	TOTAL DEPTH	WELL NAME	WELL TYPE	STATUS	ZONE	DIST
3002508371	BYARD BENNETT	2/24/61	3/8/61	5425	J L HOLLAND ETAL 001	Oil	Plugged	Delaware Sand	0.34
3002526958	BOPCO, L.P.	4/13/81	12/26/07	15007	SIMS 001	Gas	Plugged	Morrow	0.35
3002526369	EOG RESOURCES INC	9/15/79	10/8/90	14698	GOVERNMENT L COM 002	Gas	Plugged	Atoka	0.38
3002525604	EOG RESOURCES INC	10/3/77	12/30/04	17625	GOVERNMENT L COM 001	Gas	Plugged	Morrow	0.72
3002527491	SOUTHLAND ROYALTY CO	10/19/81	8/10/86	15120	SMITH FEDERAL 001	Oil	Plugged	Morrow	0.79
3002529008	EOG RESOURCES INC	11/7/84		15600	MADERA RIDGE 24 001	Gas	Active	Bone Springs	0.99

6.0 IDENTIFICATION AND REQUIRED NOTIFICATION OF OPERATORS SUBSURFACE LESSEES AND SURFACE OWNERS WITHIN THE AREA OF REVIEW

Geolex contracted with MBF Land Services in Roswell, New Mexico to research land records in Lea County to obtain a listing of all operators, oil, gas and mineral lessees, and surface owners within a one-mile radius of the proposed AGI well. Appendix C includes the results from that search.

Appendix C includes Figure C1 which shows the wells located within the one-mile area of review of the proposed Agave Red Hills AGI #1 well. Table C-1 lists the one operator within this one-mile radius, and Table C-2 lists the names and addresses of operators and subsurface lessees within the same one mile area of review. There are only two lessees within the area of review and surface ownership is mostly private with BLM owning less than a section within the 1-mile area of review. All of the land data including any nearby facilities, businesses or residences are detailed in Appendix C. There are no residences or manned facilities within the 1-mile area of review. Only one small manned electrical substation is located next to the location of Agave's proposed Red Hills Plant.

All of these operators, oil, gas and mineral lessees within the one-mile area of review and the State of New Mexico (the sole owner of record) will be provided notice and an opportunity to review this application at least 20 days prior to the NMOCC hearing, according to the requirements of Section XIV of the C-108 and NMOCD's current policy on applications for acid gas injection wells. A draft copy of this notice is included in Appendix C. The proposed public notice that will be published in the Hobbs Daily News-Sun at least 20 days prior to NMOCC hearing is also included in Appendix C.

7.0 AFFIRMATIVE STATEMENT OF LACK OF HYDRAULIC CONNECTION BETWEEN PROPOSED INJECTION ZONE AND KNOWN SOURCES OF DRINKING WATER

As part of the work performed to support this application, a detailed investigation of the structure, stratigraphy and hydrogeology of the area surrounding the proposed Agave Red Hills AGI #1 well has been performed. The investigation included the analysis of available geologic data and hydrogeologic data from wells and literature identified in Sections 3, 4 and 5 above including related appendices. Based on this investigation and analysis of these data, it is clear that there are no open fractures, faults or other structures which could potentially result in the communication of proposed injection zone with any known sources of drinking water in the vicinity as described above in Sections 4 and 5 of this application.

8.0 REFERENCES

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FIGURES

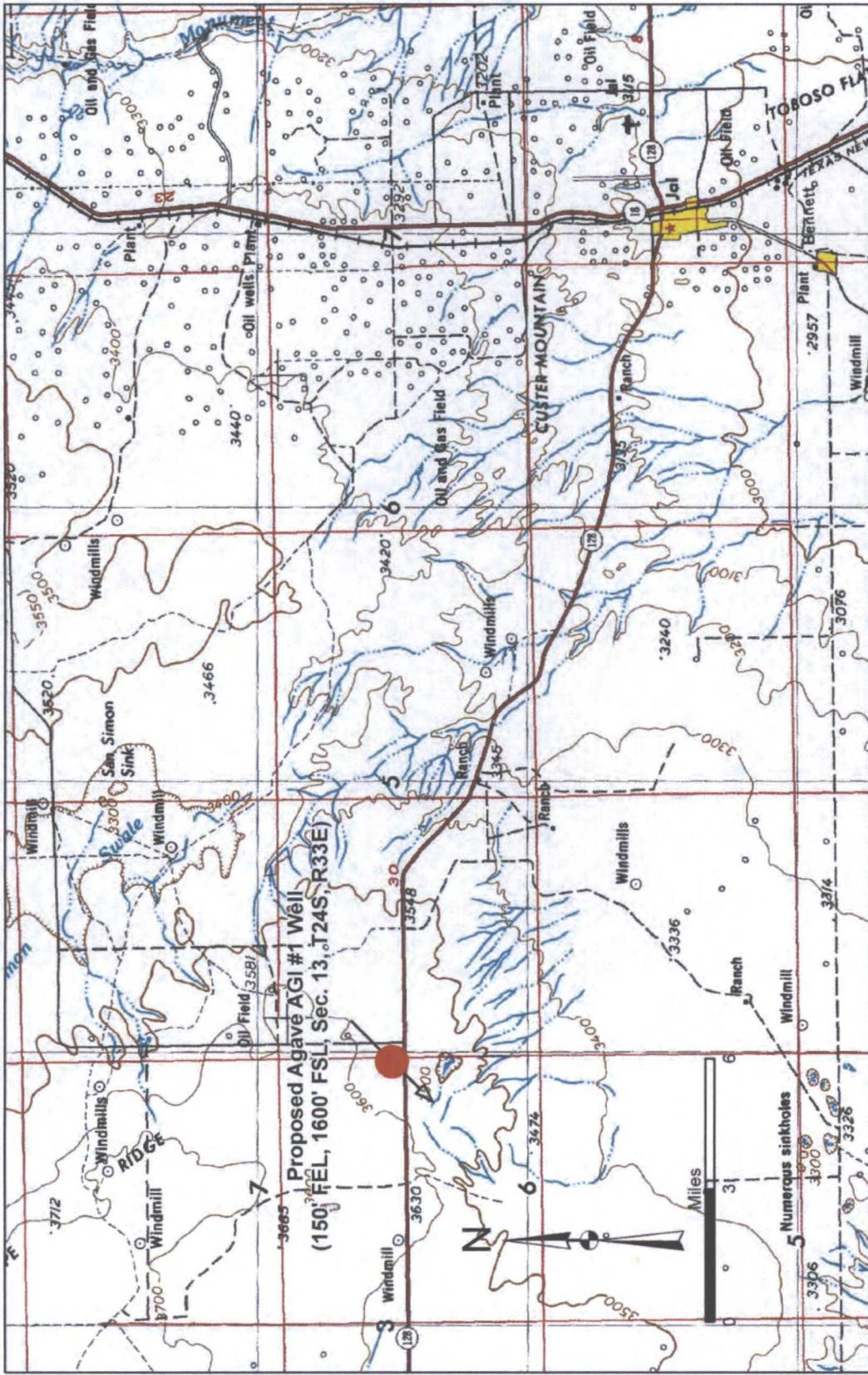
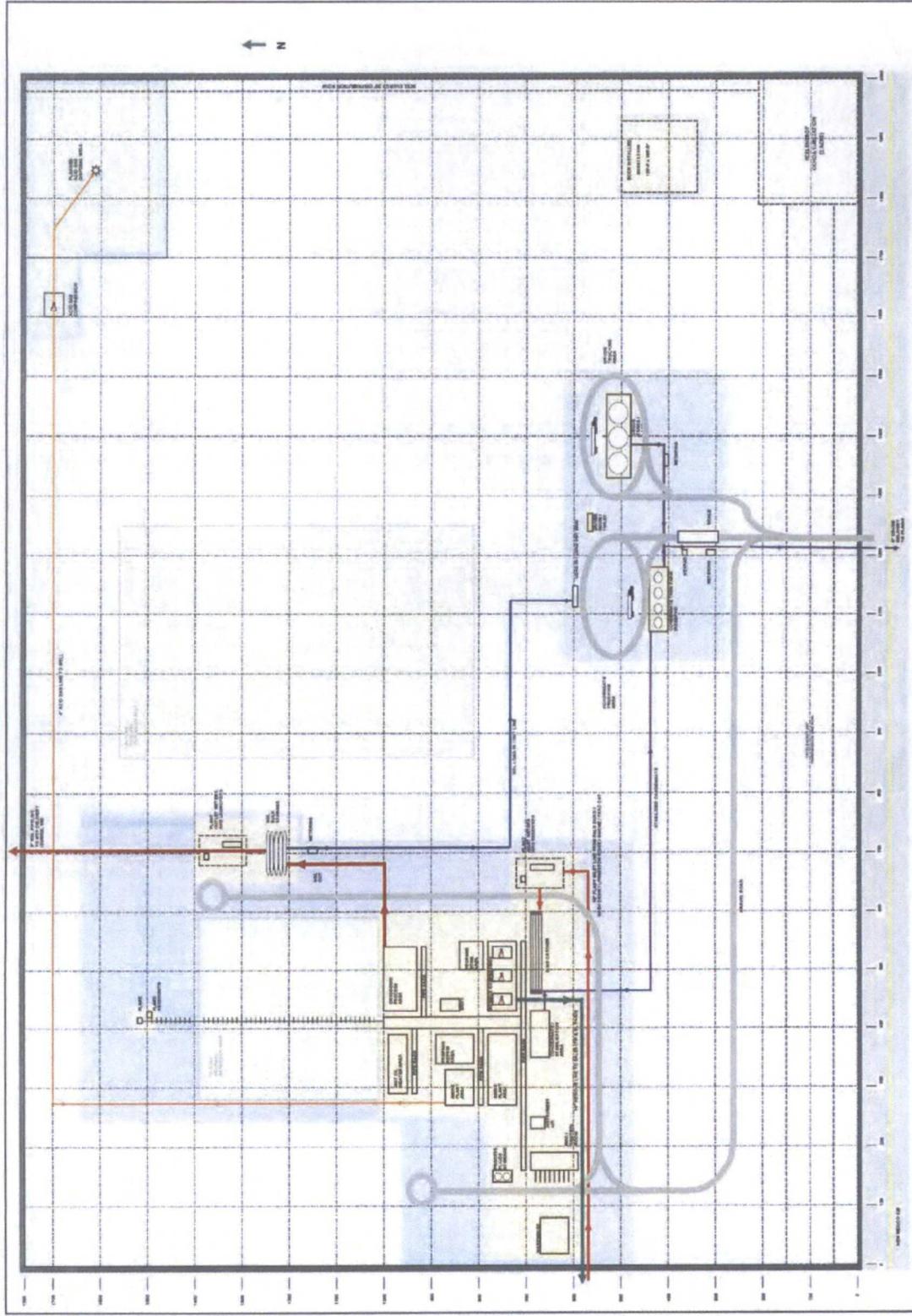


Figure 1. Location of Proposed Agave Red Hills Gas Plant and AGI #1 Well

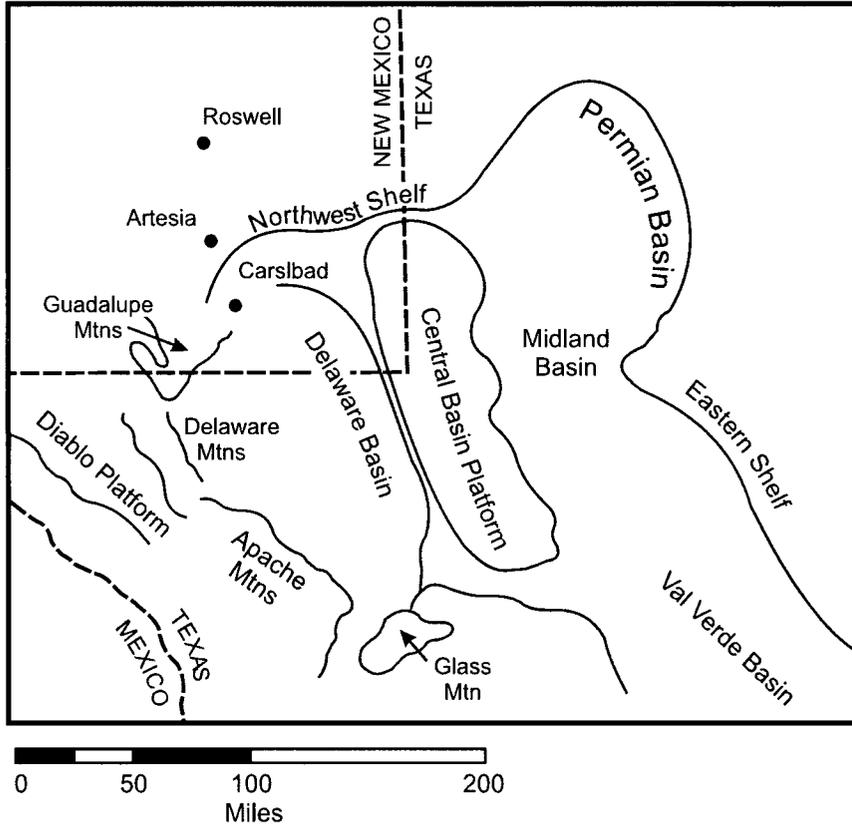
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INCORPORATED



RED HILLS PLANT LAYOUT	
SHEET NO. 101	DATE: 11/11/03
PROJECT NO. 03-001	SCALE: AS SHOWN
DRAWN BY: [Name]	CHECKED BY: [Name]
APPROVED BY: [Name]	TITLE: [Title]

Figure 2: General Plant Diagram Showing Proposed Locations of the Amine Units, Compressor Facility, and AGI Well

LATE PERMIAN



GEOLEX
INCORPORATED

Figure 5: Structural Features of the Permian Basin During the Late Permian; Modified from Ward et al. (1986)



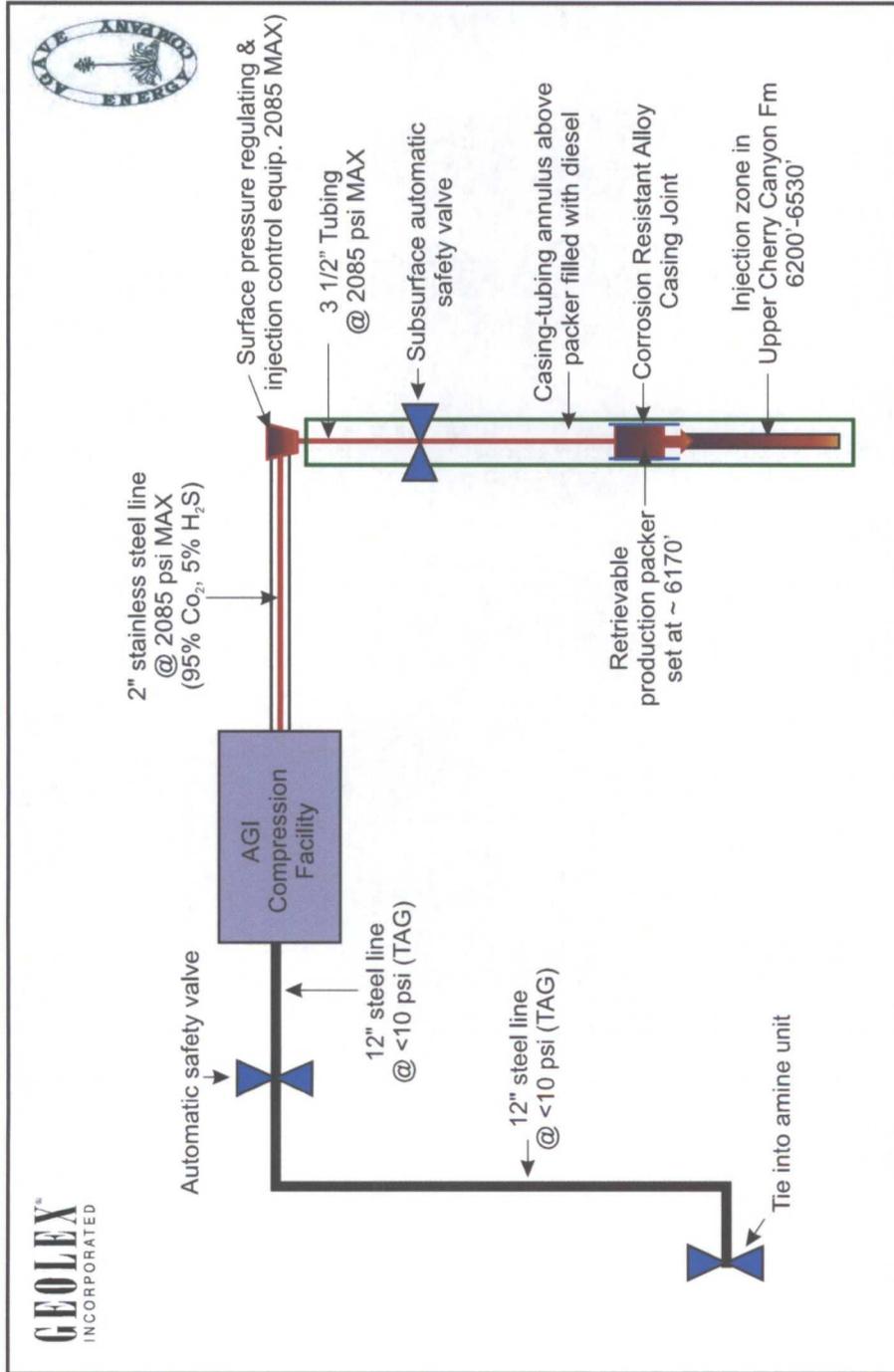


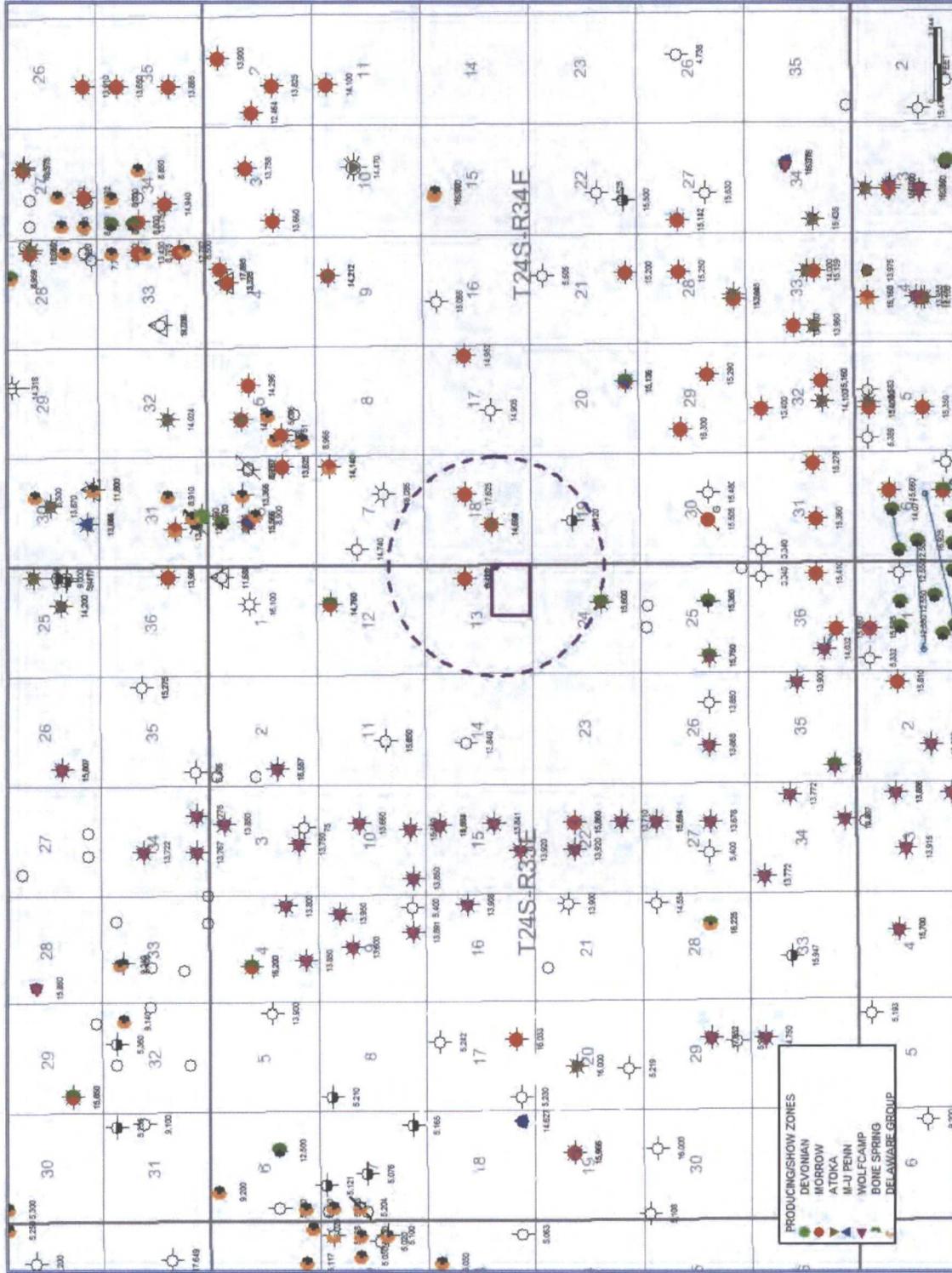
Figure 3: Schematic of Proposed Agave Red Hills Gas Plant Acid Gas Injection (AGI) System Components



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Figure 6. Generalized Stratigraphy of the Delaware Basin



GEOLEX INCORPORATED Figure 7. Oil and Gas Production in the Vicinity of the Proposed Agave Red Hills AGI #1 Well Showing One Mile Area of Review

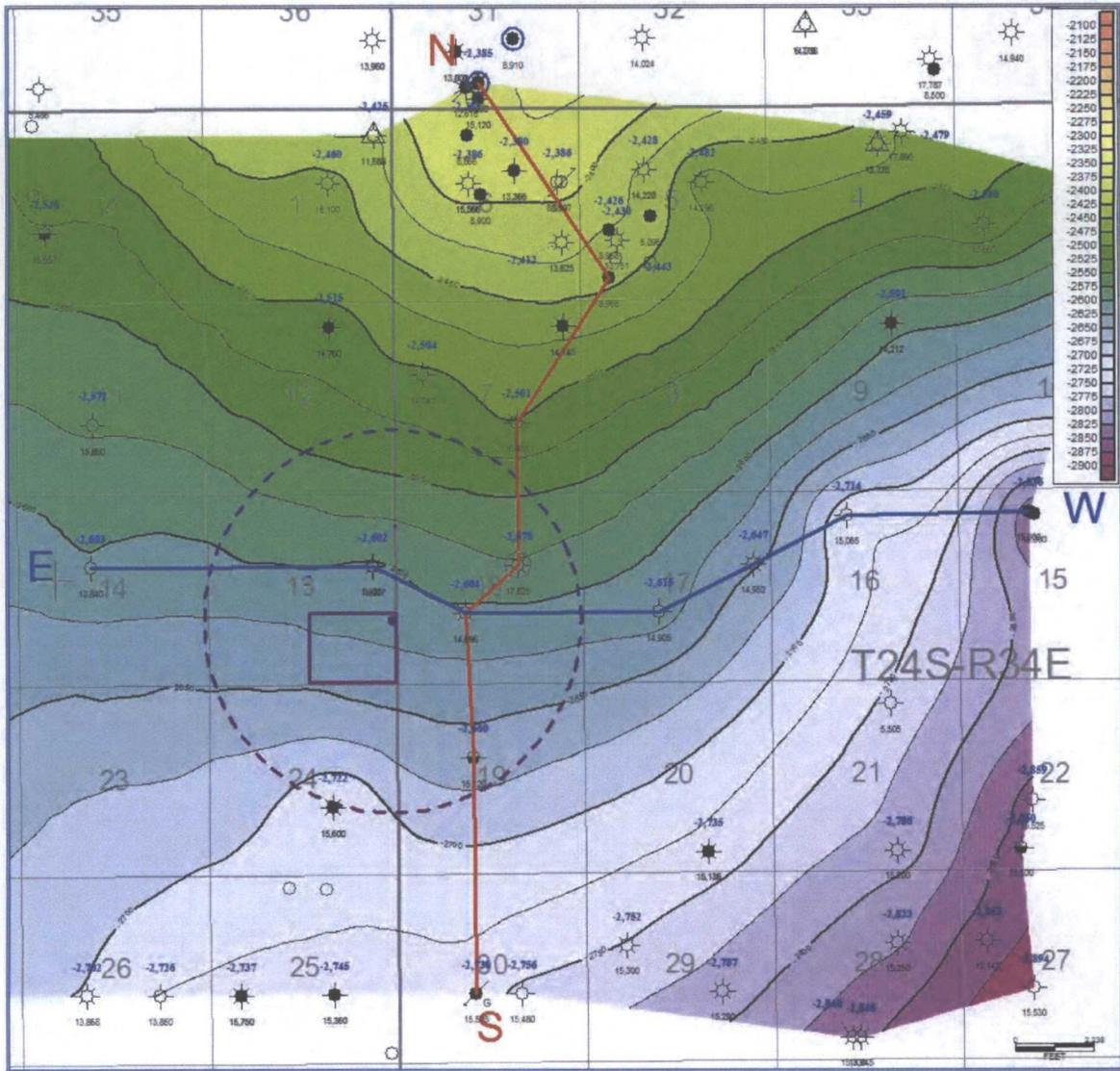
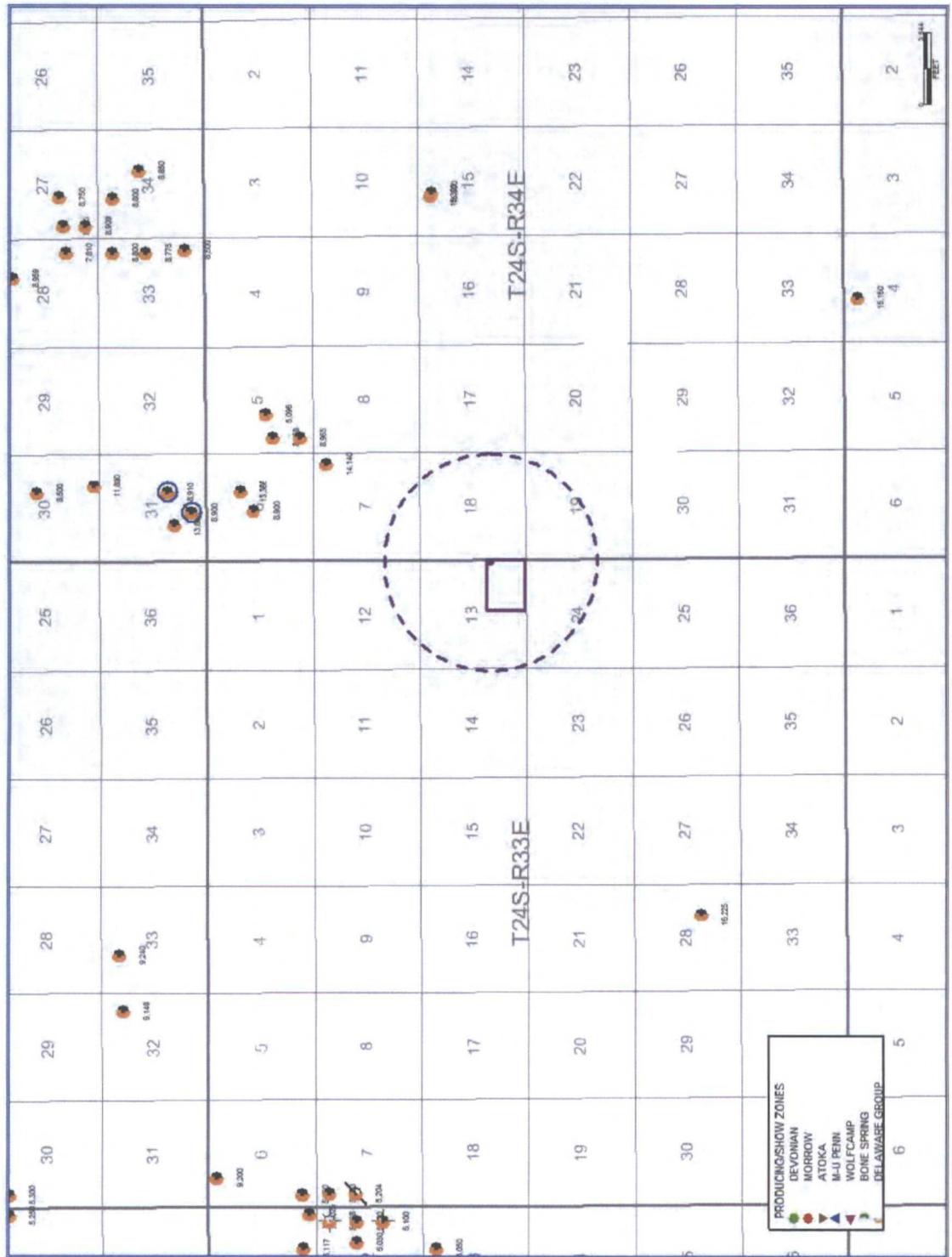


Figure 8. Structure on Top of the Cherry Canyon Formation Showing the Locations of Cross-Sections and One Mile Area of Review

GEOLEX
INCORPORATED





GOLEX INCORPORATED Figure 9. Oil and Gas Production in the Delaware Group in the Vicinity of the Proposed Agave Red Hills AGI #1 Well Showing One Mile Area of Review

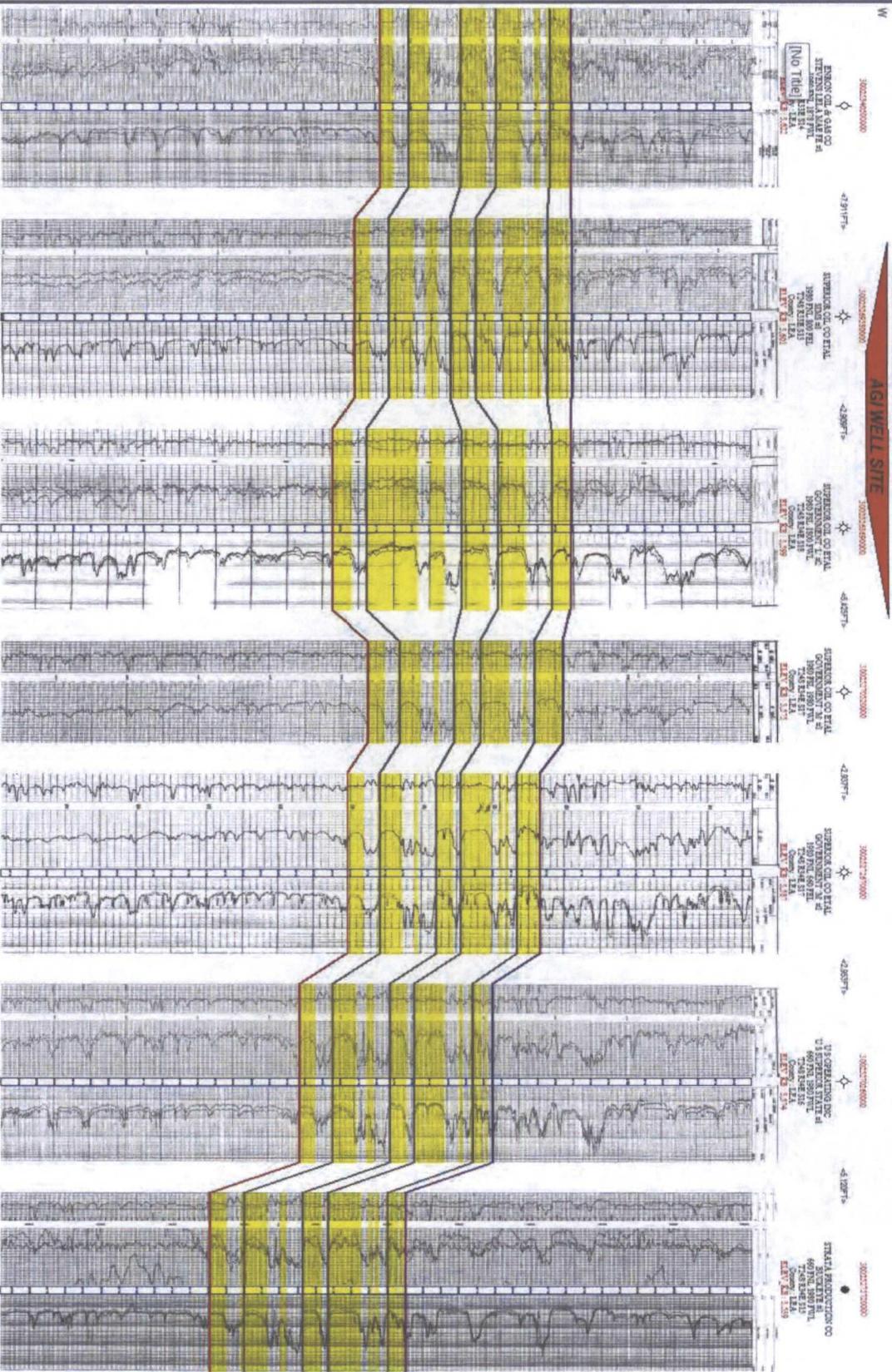


Figure 10. East-West Cross-Section Showing the Cherry Canyon Formation

GEOLEX
INCORPORATED



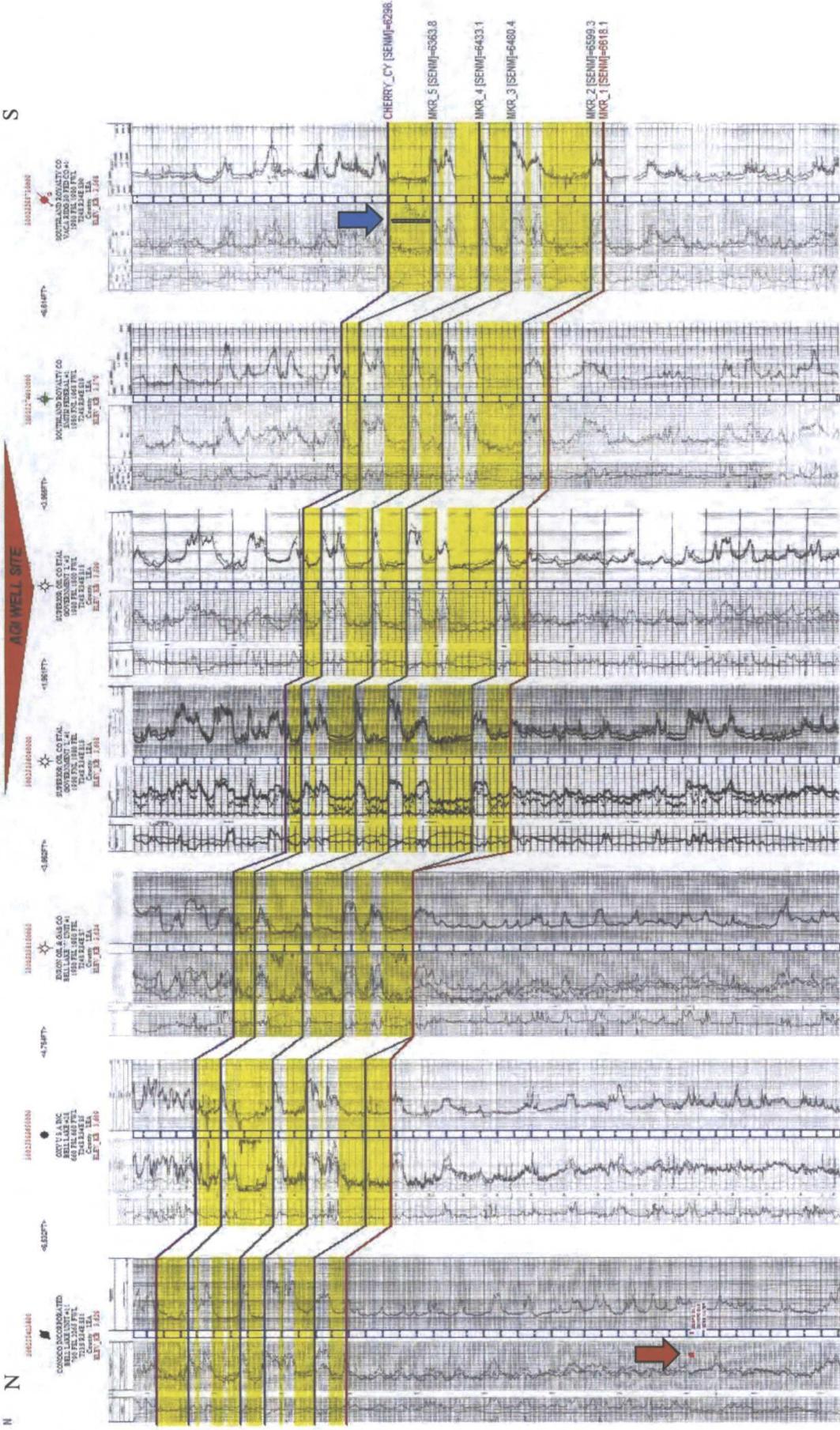
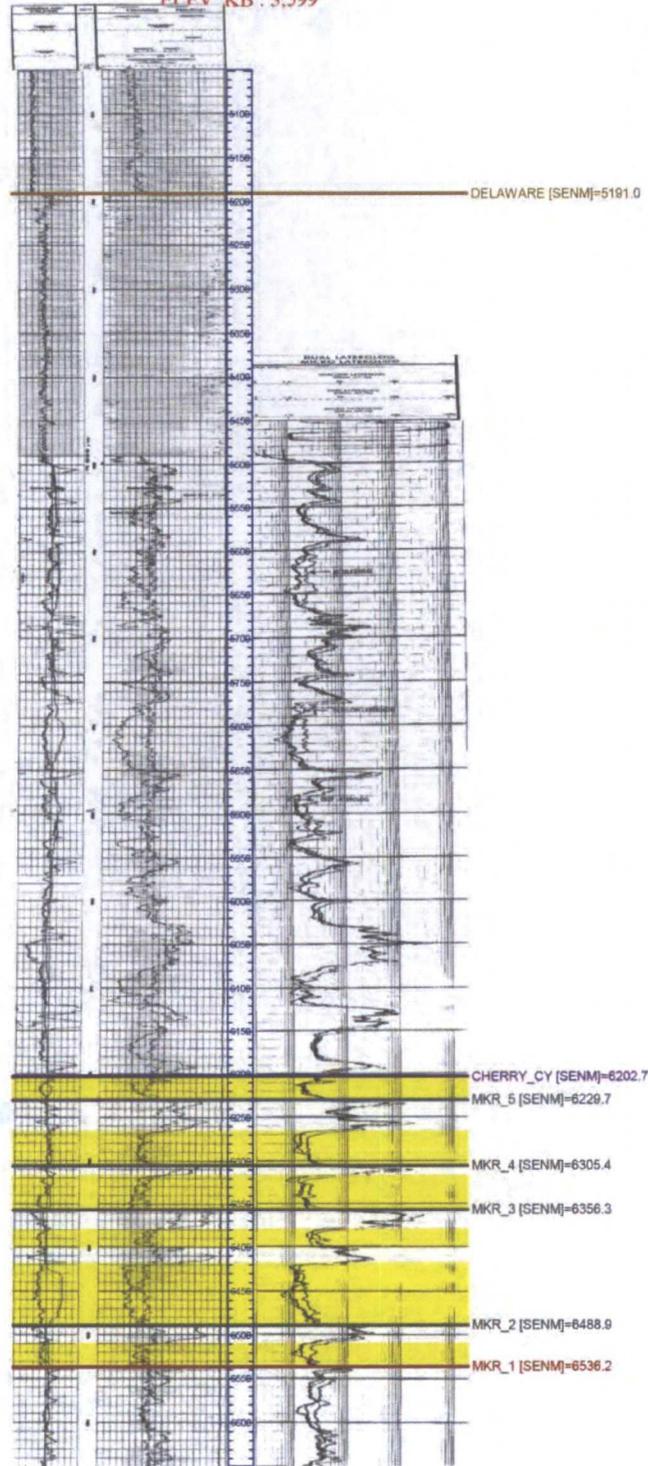


Figure 11. North-South Cross-Section Showing the Cherry Canyon Formation.
 (Note: Blue Arrow Shows Injection Interval of Closest SWD Well. Red Arrow Indicates Location of Cherry Canyon Production within Two Wells Located More Than 2.5 Miles to the North.)

3002526369000



SUPERIOR OIL CO ETAL
GOVERNMENT 'L' #2
1980 FSL 1800 FWL
T24S R34E S18
County : LEA
ELFV KB : 3,599



GEOLEX
INCORPORATED



Figure 12. Geophysical Logs of the Bell Canyon and Upper Cherry Canyon from the Government 'L' #2 Well, Located 0.38 Miles from the Proposed Agave Red Hills AGI #1.

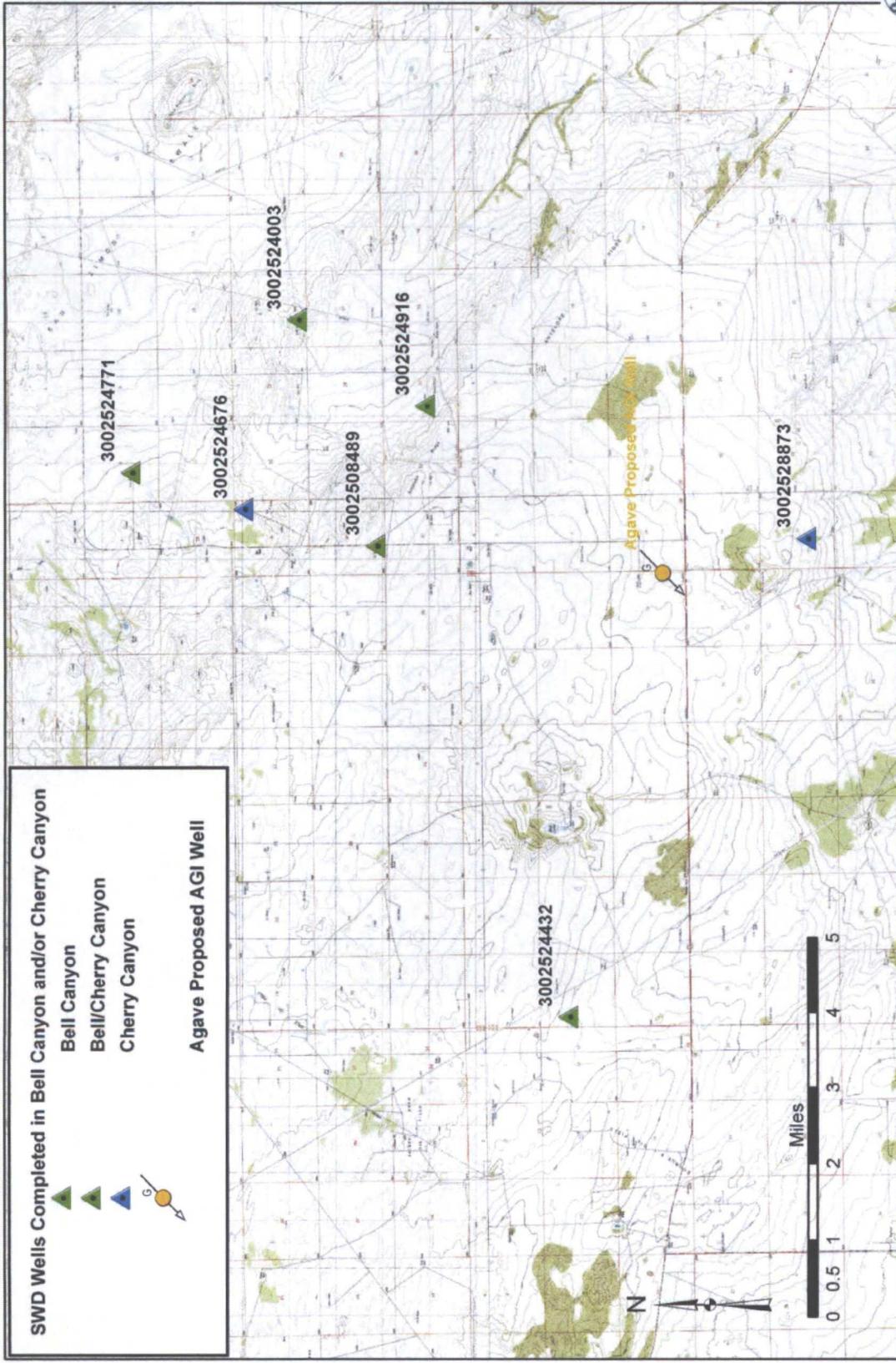


Figure 14. Locations of Salt Water Disposal Wells Completed in Bell Canyon and/or Cherry Canyon within Ten Miles of Proposed Agave Red Hills AGI #1 Well.

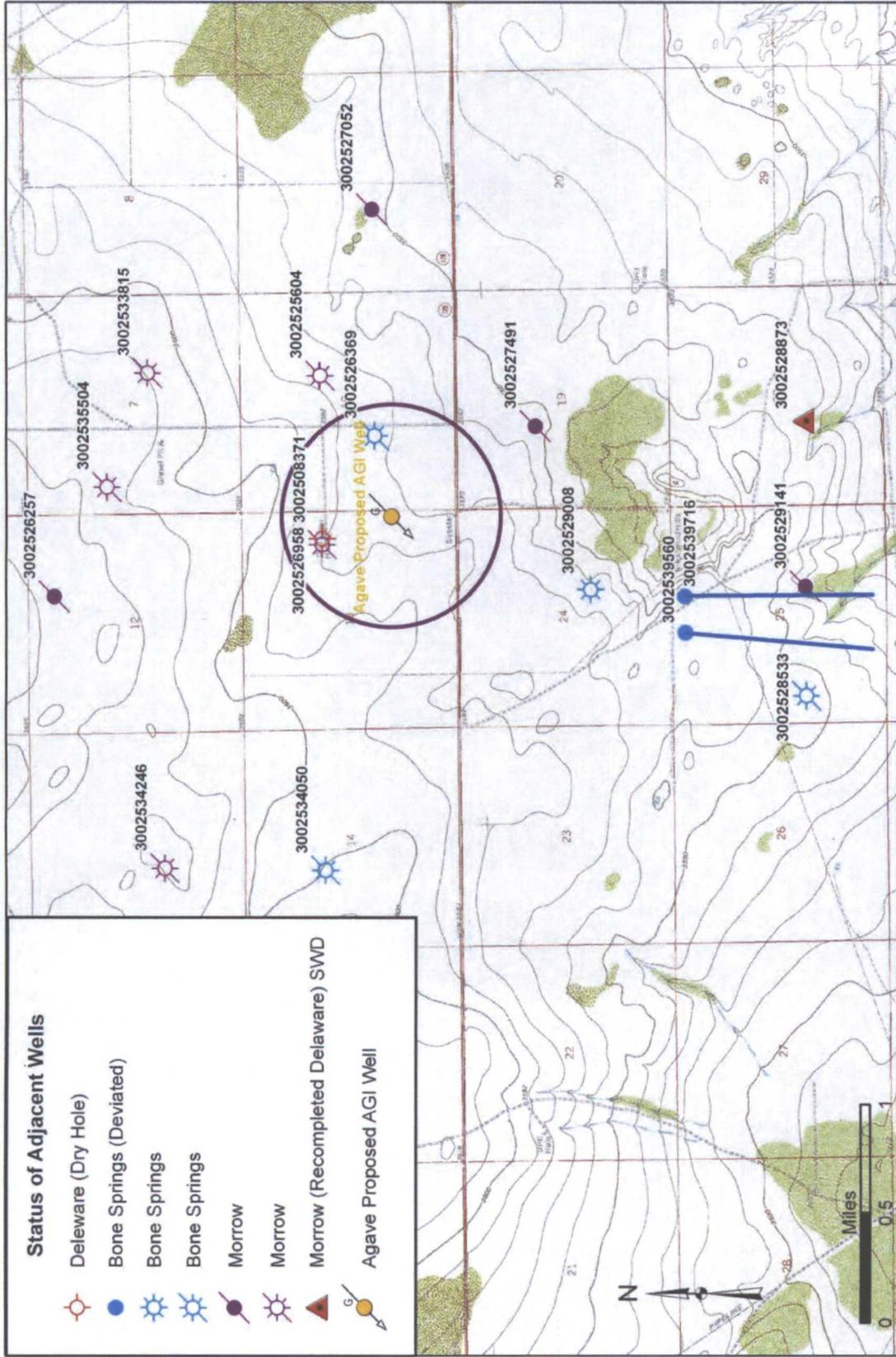


Figure 15. Calculated Area of Injection After 30 Years at 13 MMSCFD

— Calculated Radius of Injection After 30 Years at 13 MMSCFD

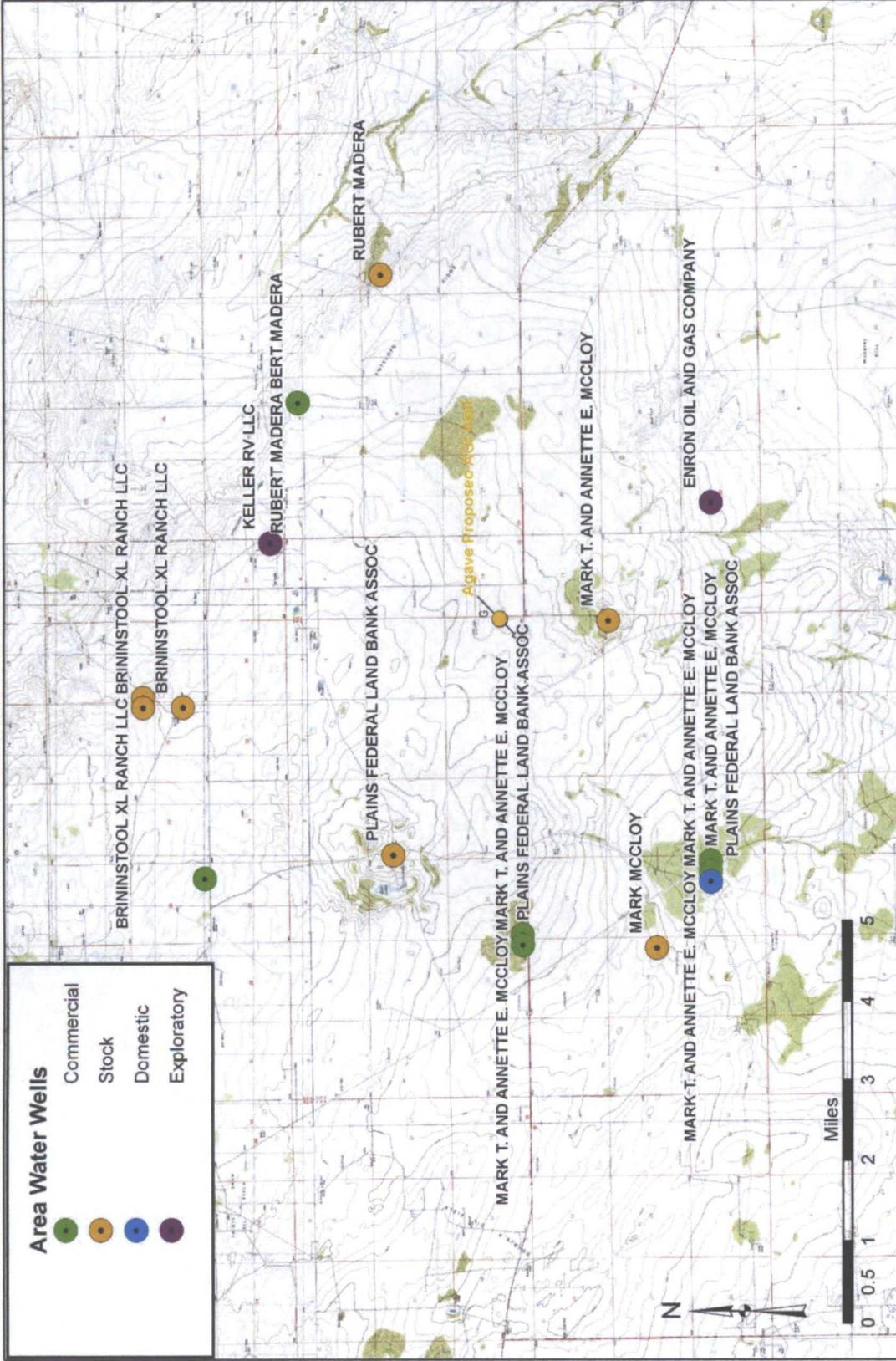


Figure 16. Locations of Water Wells within Five Miles of Proposed Agave Red Hills AGI #1 Well

APPENDICES

APPENDIX A

Predicted Injection Fluid Composition, Cherry Canyon Reservoir Conditions and Formation Fluid Analysis

Table A1: Agave Red Hills AGI #1 Predicted Injection Fluids Composition

Treated Acid Gas

CO ₂	95%
H ₂ S	5%
C ₁ -C ₆	trace
N ₂	trace

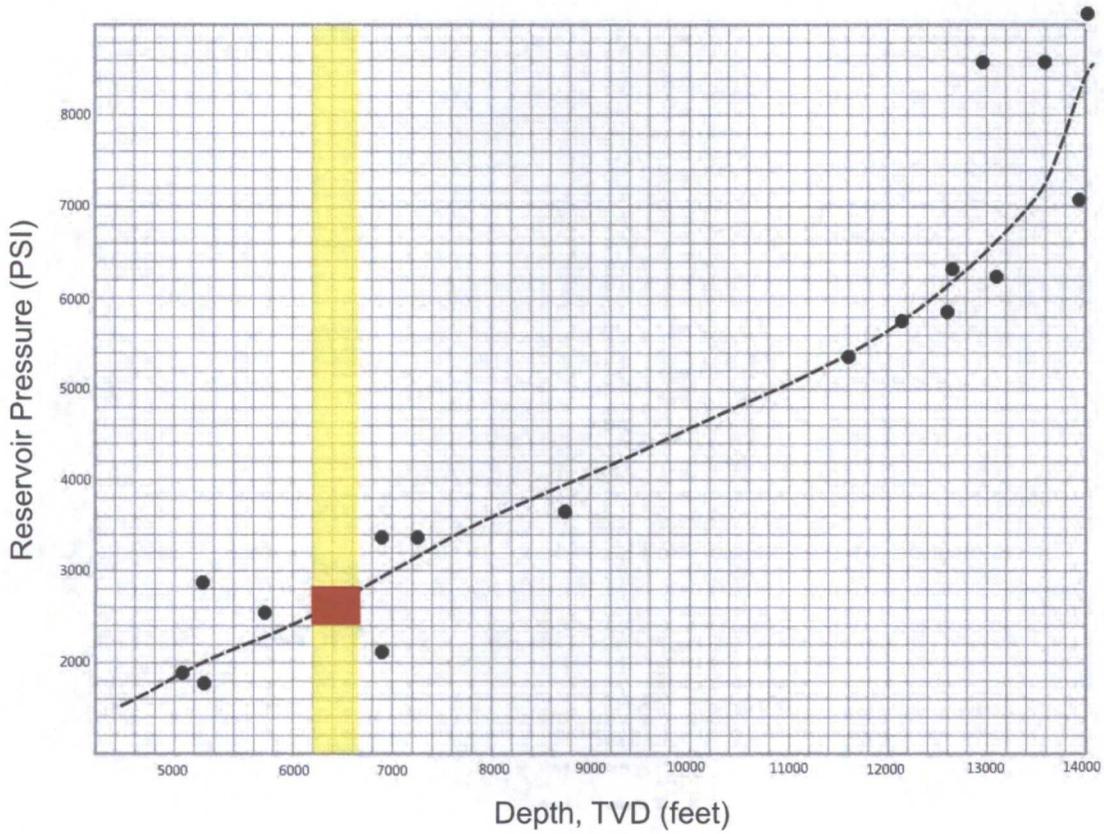


Figure A1. Plot of Reservoir Temperatures as a Function of Depth at Wells in the Vicinity of the Proposed Red Hills AGI #1. Yellow Bar Indicates the Planned Injection Depth for the Well.

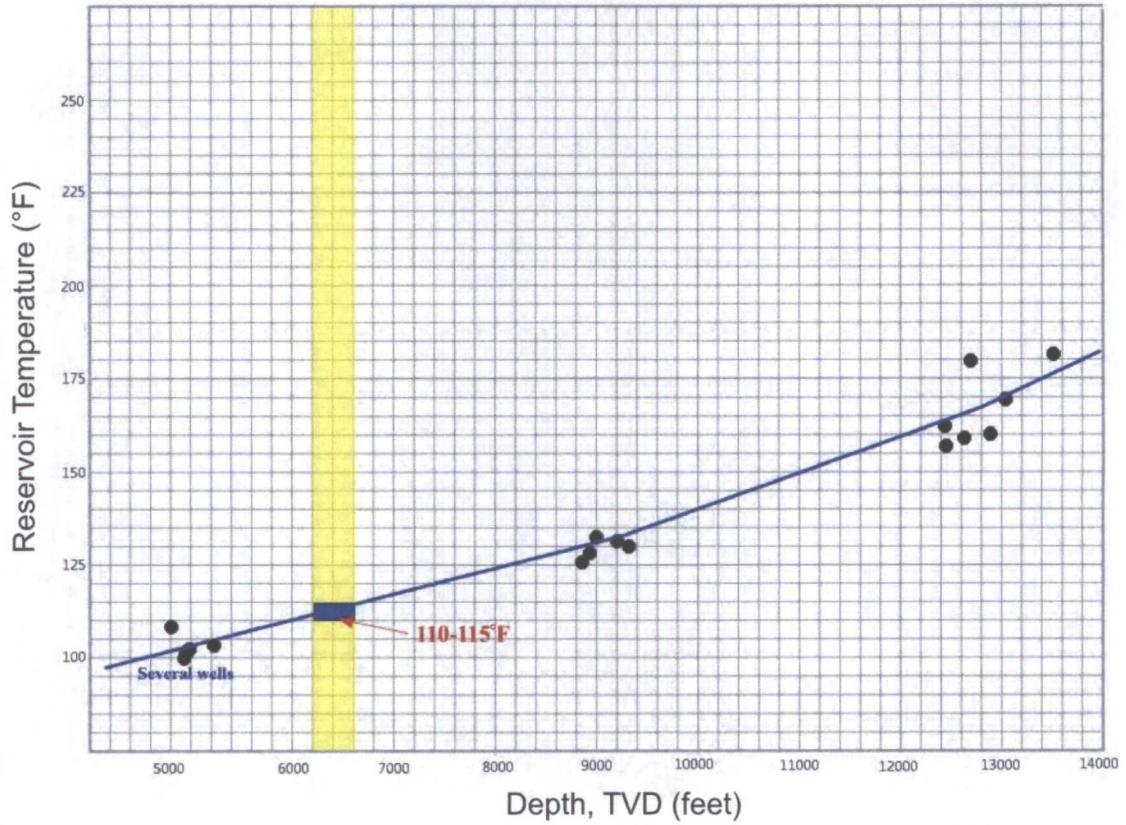


Figure A2. Plot of Reservoir Pressures Measured During Drill Stem Tests (DSTs) at Wells in the Vicinity of the Proposed Red Hills AGI #1. Yellow Bar Indicates the Planned Injection Depth for the Well.

Table A2: Formation Fluid Analysis Cherry Canyon Formation

Extract from C-108 Application to Inject by Ray Westall
Associated with SWD-1067 - API 30-025-24676

Water analysis:

Ray Westall Federal 30 #2
7335-45' Delaware

API 30-025-29069
Located 6.34 miles from Proposed
Agave Red Hills AGI #1

Sp. Gravity	1.125 @ 74	Resistivity	.07 @ 74
pH	7	Sulfate	1240
Iron	Good/Good	Bicarbonate	2135
Hardness	45000	Chloride	110000
Calcium	12000	Sod Chloride	180950
Magnesium	3654	Sod & Pot	52072

APPENDIX B

Active Oil and Gas Well Data; Permanently Plugged Oil and Gas Well Data

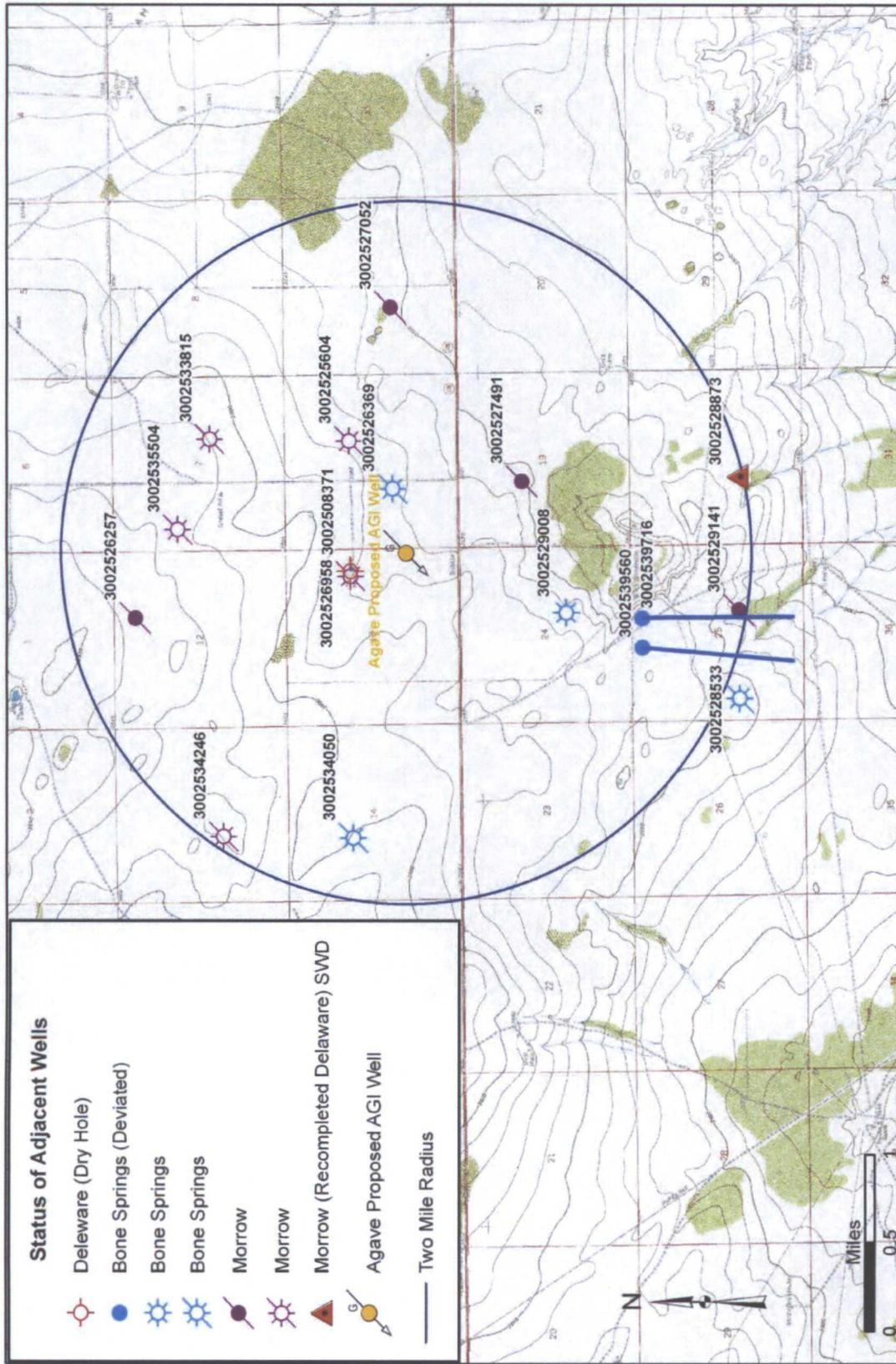


Figure B1: Wells Within Two-Mile Radius of Agave Proposed Red Hills AGI #1 Well

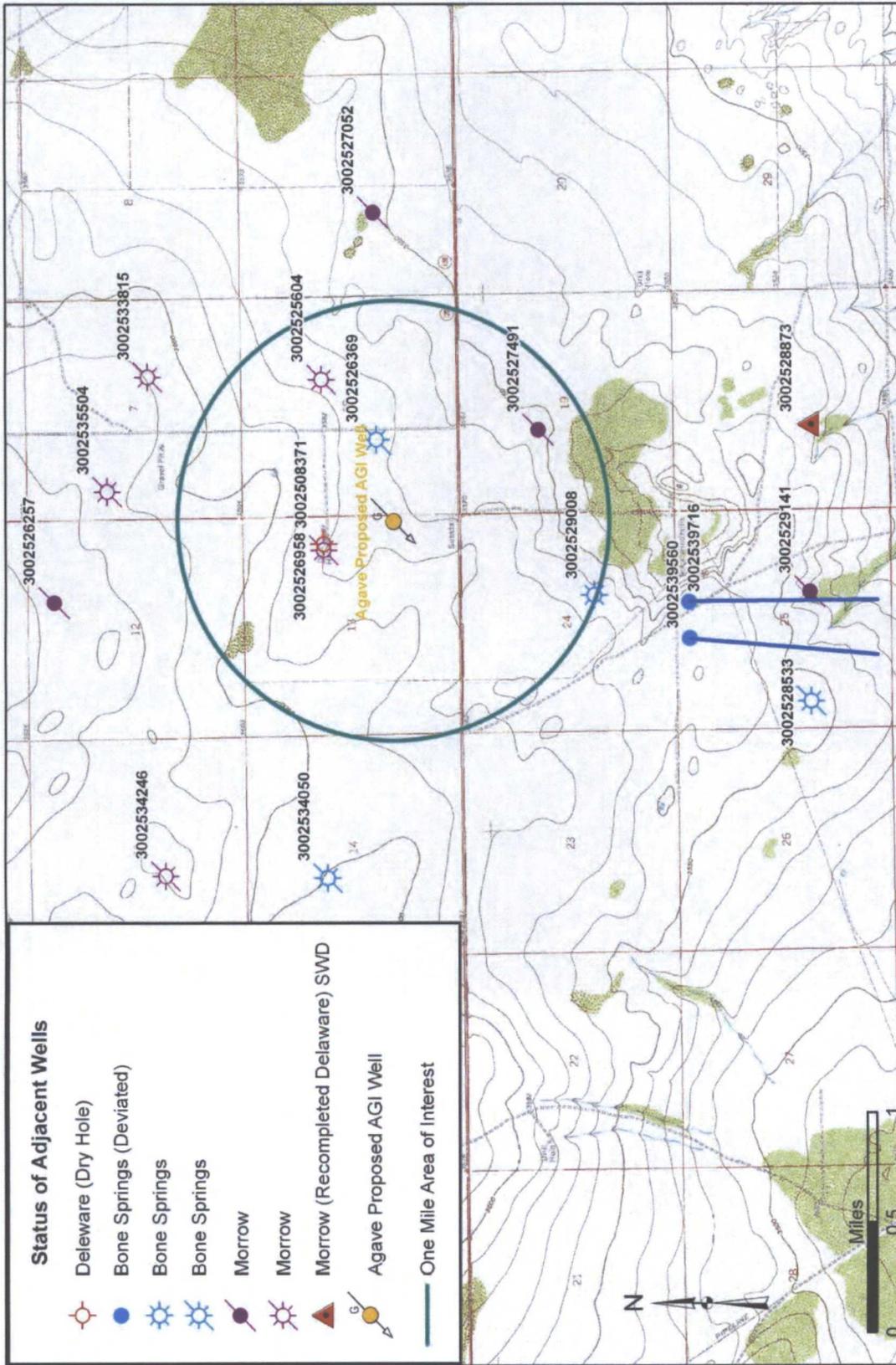


Figure B2: Wells Within One-Mile Area of Interest Around Agave Proposed Red Hills AGI #1 Well

Table B-1: Wells Within Two Miles of the Proposed Red Hills AGI #1

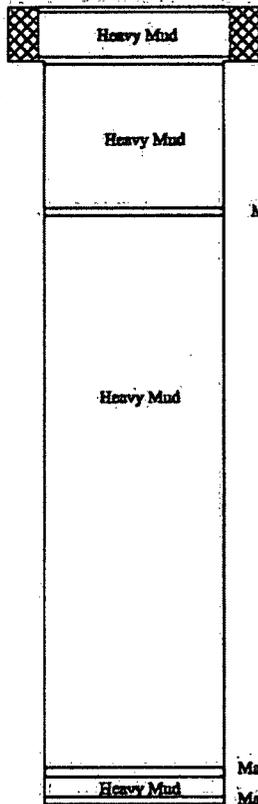
API	OPERATOR	PLUG	SPUD	PBTD	TD	WELL NAME	TYPE	STATUS	DIST	ZONE
Wells Inside of One Mile Area of Review										
3002508371	BYARD BENNETT	3/8/61	2/24/61	5425	J.L. HOLLAND ETAL 001	O	Plugged	0.34		DELAWARE SAND
3002526958	BOPCO, L.P.	12/26/07	4/13/81	14916	SIMS 001	G	Plugged	0.35		MORROW
3002526369	EOG RESOURCES INC	10/8/90	9/15/79	13725	GOVERNMENT L COM 002	G	Plugged	0.38		ATOKA
3002525604	EOG RESOURCES INC	12/30/04	10/3/77	14590	GOVERNMENT L COM 001	G	Plugged	0.72		MORROW
3002527491	SOUTHEAST ROYALTY CO.	8/10/86	10/19/81	15018	SMITH FEDERAL 001	O	Plugged	0.79		MORROW
3002529008	EOG RESOURCES INC		11/7/84	12894	MADERA RIDGE 24 001	G	Active	0.99		BONE SPRINGS
Wells Outside of One Mile Area of Review										
3002533815	EOG RESOURCES INC	9/10/97	6/12/97	16085	BELL LAKE 7 UNIT 001	G	Plugged	1.31		MORROW
3002535504	EOG RESOURCES INC	5/13/01	4/24/01	14500	BELL LAKE UNIT 008	G	Plugged	1.33		MORROW
3002527052	SUPERIOR OIL CO.	11/8/82	12/14/80	14776	GOVERNMENT M 001	O	Plugged	1.40		ATOKA
3002539716	YATES PETROLEUM CORP		4/1/10	13784	RED RAIDER BKS STATE 002H	O	Active	1.42		BONE SPRINGS
3002539560	EOG RESOURCES INC		11/30/09	13685	FALCON 25 FEDERAL 001	O	Active	1.47		BONE SPRINGS
3002526257	KAISER-FRANCIS OIL CO		3/25/79	14717	BELL LAKE UNIT 019	O	Zone Plug	1.61		MORROW
3002534050	EOG RESOURCES INC	3/13/02	10/23/97	13840	LELA MAE STEVENS FEDERAL COM 001	G	Plugged	1.65		BONE SPRINGS
3002524910	KAISER-FRANCIS OIL CO		1/31/75	8600	BELL LAKE UNIT 016	G	Active	1.81		BRUSHY CANYON
3002527267	MOBIL PROD. TX & NM	2/21/89	10/28/88	13642	GOVERNMENT M 002	G	Plugged	1.92		ATOKA
3002534246	DEVON ENERGY PROD.	11/1/02	1/20/98	14150	STEVENS 11 001	G	Plugged	1.93		MORROW
3002529141	ENRON OIL & GAS CO	5/19/88	3/29/85	15360	RATTLESNAKE GULCH 25 001	O	Plugged	1.96		WOLF CAMP
3002528873	EOG RESOURCES INC		9/12/84	6500	VACA RIDGE 30 FEDERAL 001	S	Active	1.97		BELL/CHERRY CANYON

Note: Diagrams for all wells (active and plugged) within one mile area of review follow this table.

J. L. HOLLAND et al No. 1
API # 3002508371
1980' FNL 660' FEL, Sec: 13, T24S R33E

GL: 3572'

12.25" Bore to 367'
8.625" Cag. to 365'
200 Sx. Cont. to Surface



March 1961: 5 ex and P&A Marker

March 1961: 20 ex 340' -390'

March 1961: 20 ex 1375' -1425'

Spud Date: Feb. 24, 1961
Operator: Byard Bennett
P&A Mar. 12, 1961
Last Operator: Byard Bennett

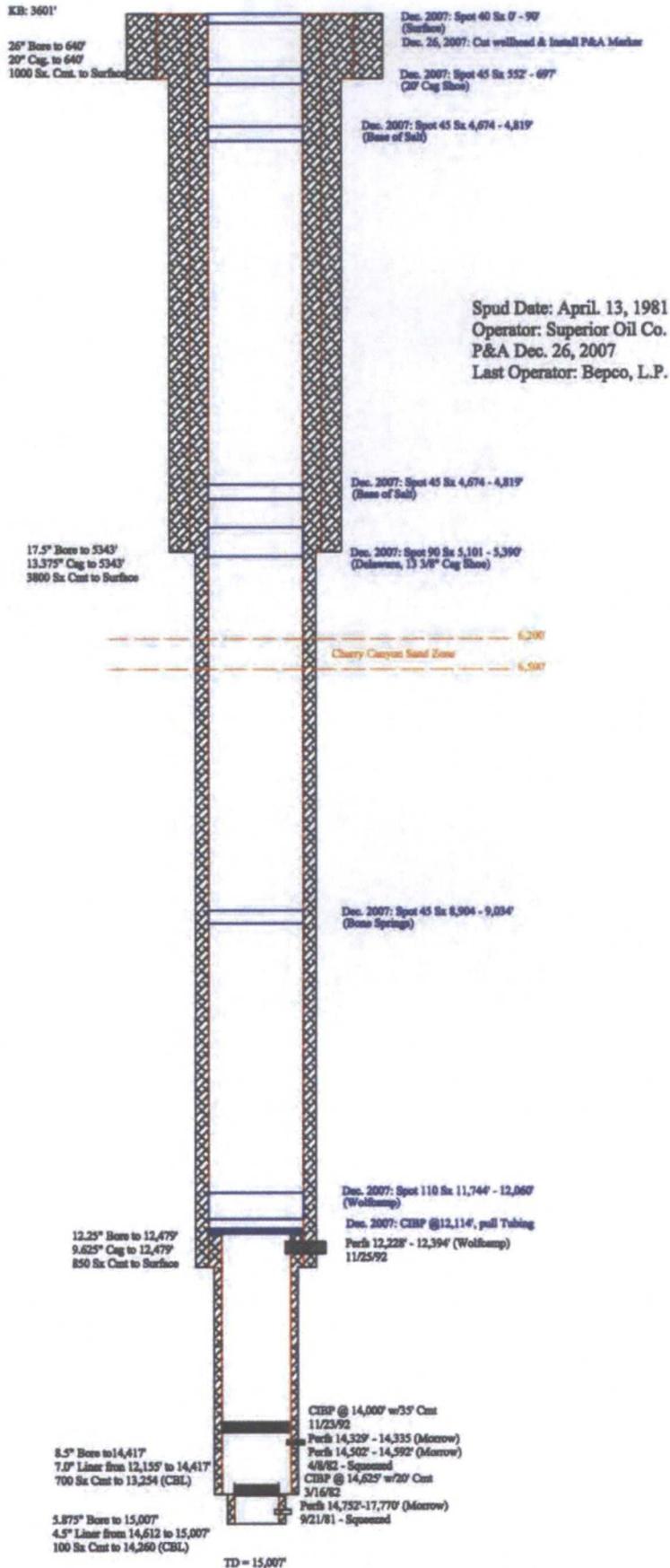
7.875" Bore to 5425'
Dry Hole - No Casing

March 1961: 20 ex 5175' -5240'

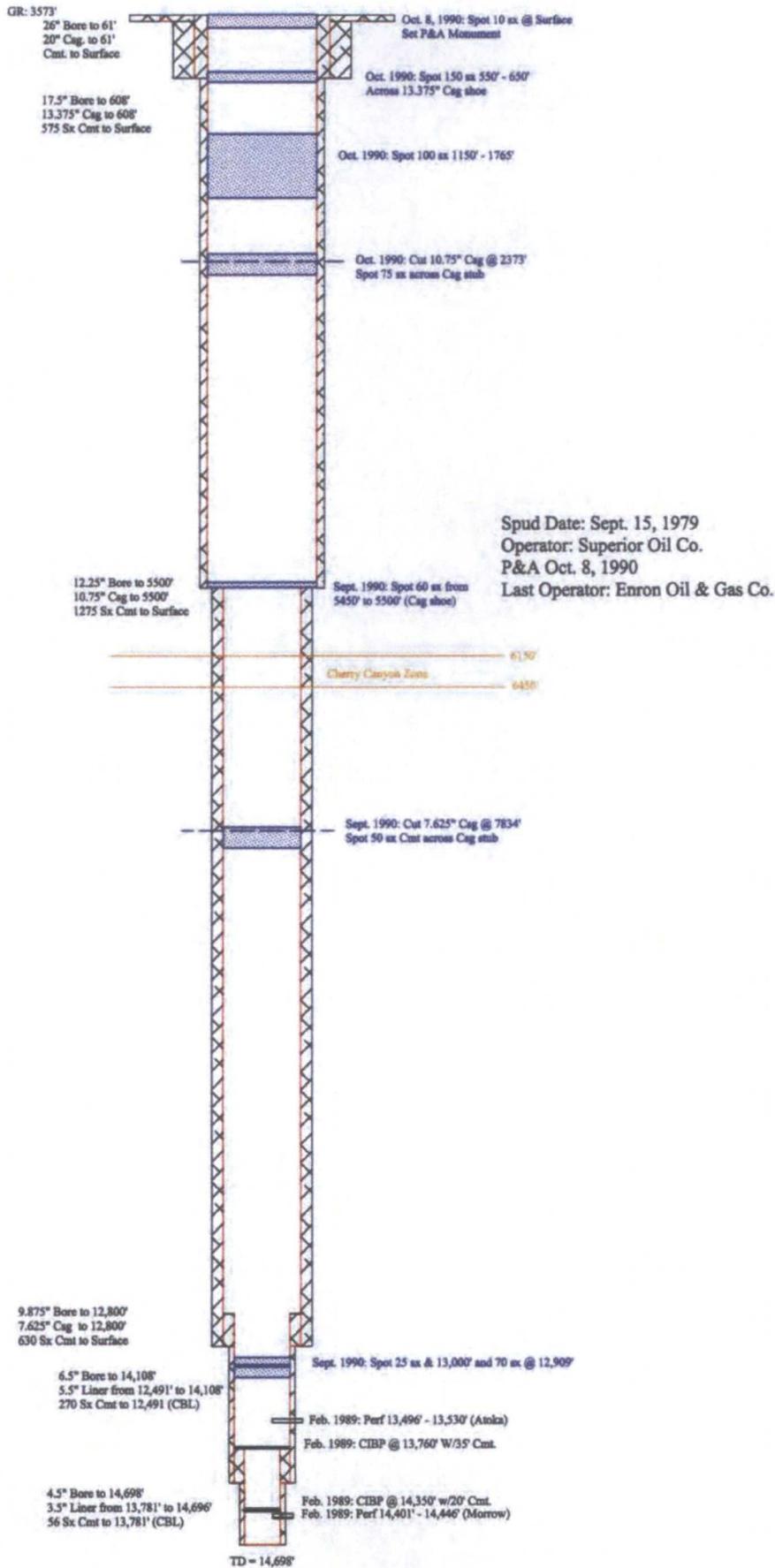
March 1961: 15 ex 5375' -5425'

TD = 5425'

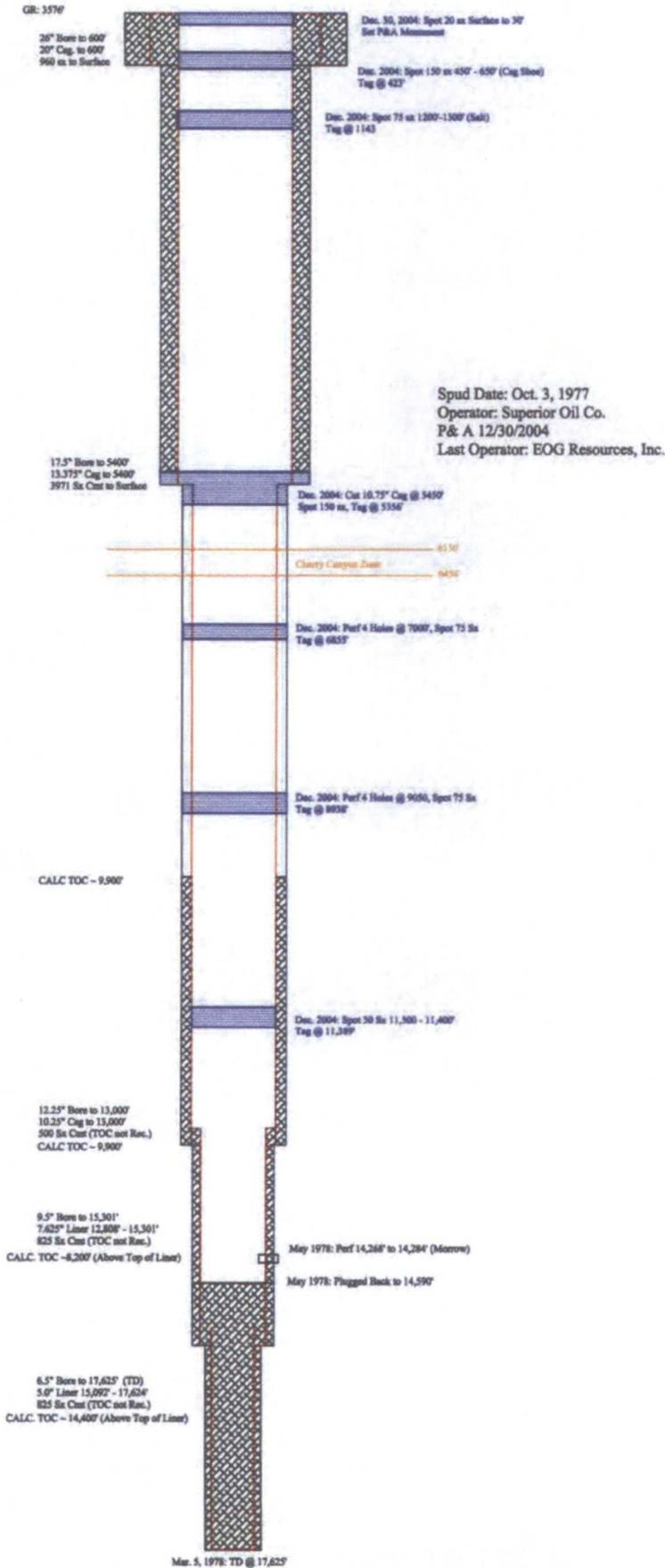
SIMS 001
 API # 3002526958
 1980' FNL 800' FEL, Sec. 13, T24 R33E



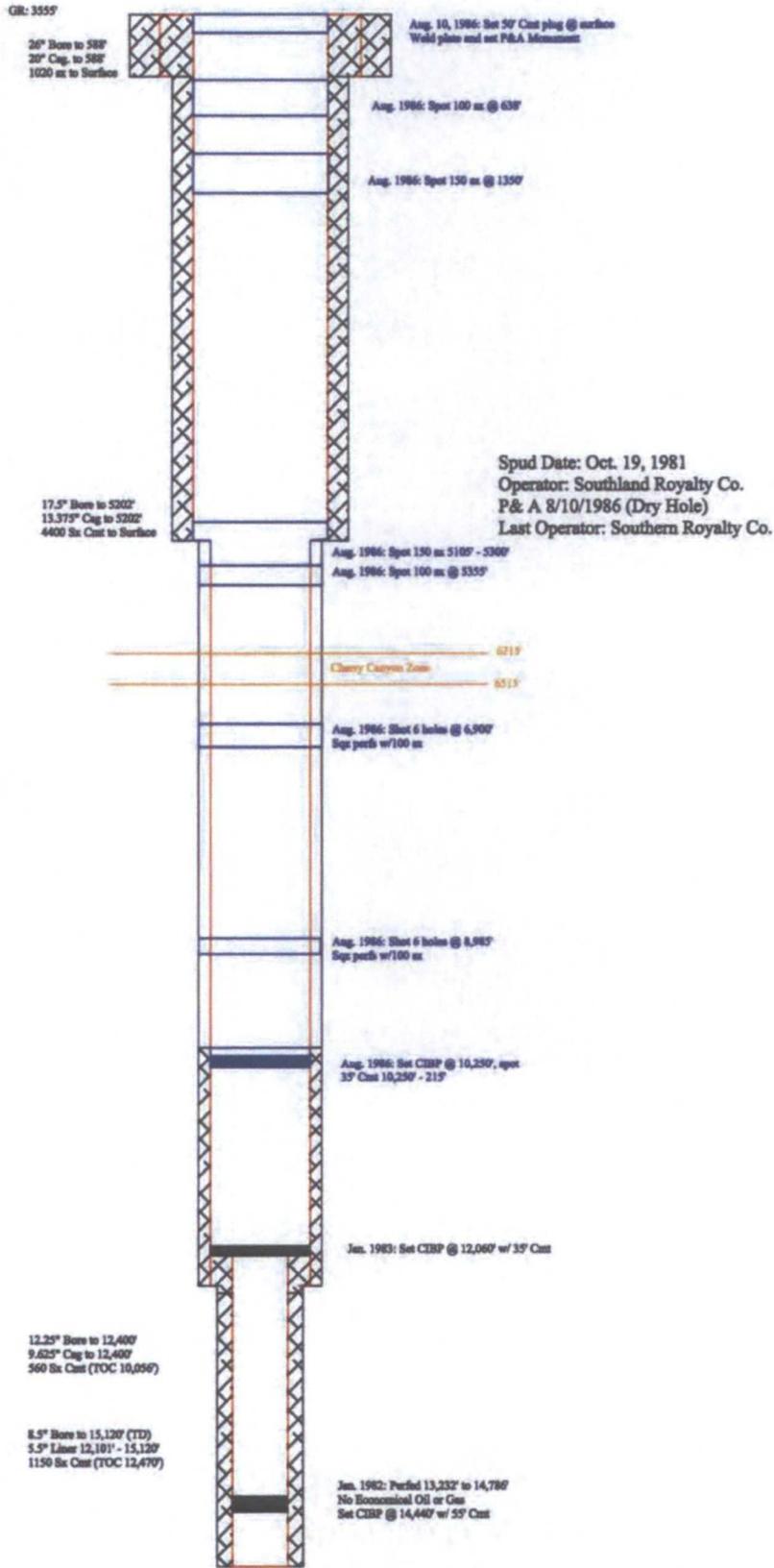
GOVERNMENT L COM 002
 API # 3002526369
 1980' FSL 1800' FWL, Sec. 18, T24 R34E



GOVERNMENT "L" COM #1
 API # 3002525604
 1980' FNL 1980' FEL, Sec. 18, T24 R34E

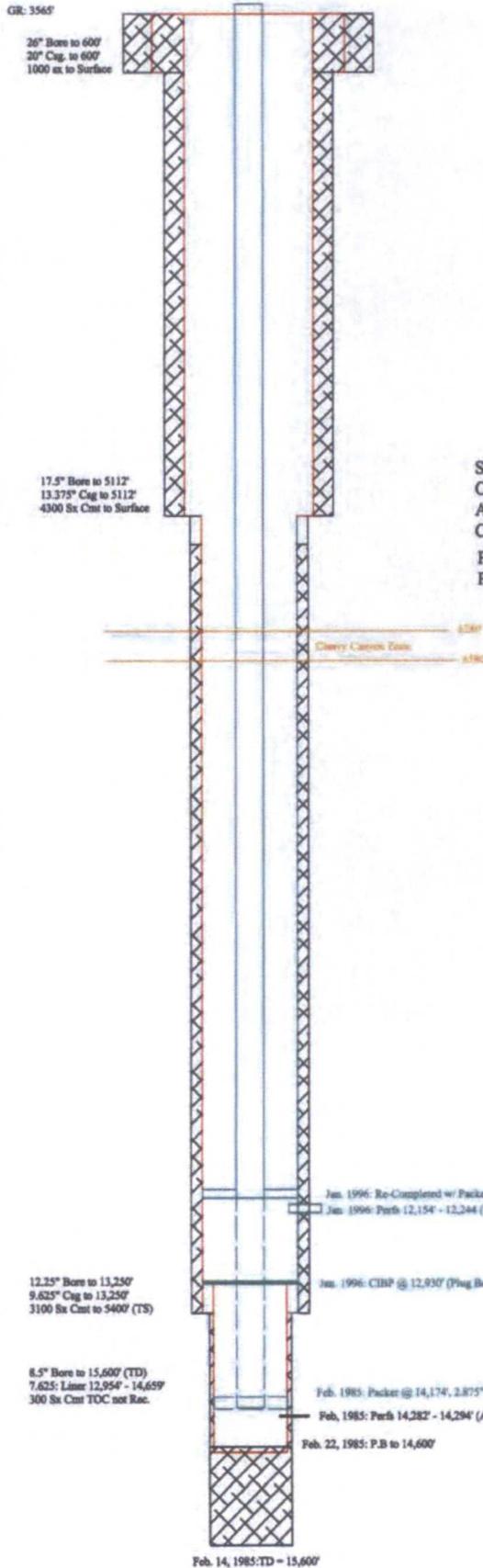


SMITH FEDERAL 001
 API # 3002527491
 1980' FNL 1968' FWL, Sec. 19, T24 R34E



Feb. 14, 1983: TD = 15,120' FB to 15,018'

MADERA RIDGE 24 001
 API # 3002529008
 1980' FSL 1980' FEL, Sec. 24, T24 R33E



APPENDIX C

**Operators, Lessees and Surface Owners
in Area of Review; Applicable Notices
Including: Proposed Notice to Operators
and Leaseholders; Proposed Notice to
Surface Owners; and Proposed Public
Notice**

TABLE C-1

**OPERATORS WITHIN ONE MILE RADIUS
OF PROPOSED AGAVE RED HILLS AGI #1**

EOG Resources Inc
P.O. Box 2267
Midland ,TX 79702

TABLE C-2

**SURFACE OWNERS ON WITHIN ONE MILE RADIUS
OF PROPOSED AGAVE RED HILLS AGI #1**

Township 24 South, Range 33 East

Section 12:

ALL

Robert Madera Trust
% Bert Madera
24 Antelope Road
Jal, NM 88252

Section 13:

E/2 Less & Except two tracts of a combined 81.76 acres in the SE/4; E/2 W/2;

Robert Madera Trust
% Bert Madera
524 Antelope Road
Jal, NM 88252

A 79.69 acre tract in the SE/4, more particularly described as follows:

Beginning at the Northeast Corner of this tract, which lies S00°26'52"E along the East line of said section a distance of 755.87 feet from the East corner of said section; then S00°26'52"E along the East line of said section a distance of 1567.13 feet; then S89°33'08"W a distance of 300.00 feet; then S00°26'52"E a distance of 194.74 feet to a point on the North right-of-way line of State Highway 128; then S89°37'22"W along said North right-of-way line a distance of 1700.00 feet to the Southwest corner of this tract; then N00°26'52"W 1765.24 feet to the Northwest corner of this tract; then N89°37'22"E a distance of 2000.0 feet to the point of beginning and containing 79.69 acres more or less

Agave Energy Company
105 S. Fourth Street
Artesia, NM 88210

A 2.07 acre tract in the SE/4 SE/4, more particularly described as follows:

Beginning at a point which lies South 2323 feet from the East Quarter corner of the above said Section, thence south a distance of 300 feet, thence East along and adjacent to the North right of way fence of State Highway #1289 a distance of 300 feet, thence North a distance of 300 feet to the point of beginning, containing 2.07 acres, more or less.

Southwestern Public Service Company
414 Nicollet Mall

Minneapolis, MN 55401

W/2 W/2;

Mark T. McCloy
P. O. Box 1076
Jal, NM 88252

Section 24:

W/2 W/2;

United States of America
Bureau of Land Management
P. O. Box 27115
Santa Fe, NM 87502

Grazing Lessee:

Mark T. McCloy
P. O. Box 1076
Jal, NM 88252

NE/4; E/2 NW/4; SE/4; N/2 E/2 SW/4;

Robert Madera Trust
% Bert Madera
524 Antelope Road
Jal, NM 88252

Township 24 South, Range 34 East

Section 7:

Lots 3, 4; E/2 SW/4; SE/4

Robert Madera Trust
% Bert Madera
524 Antelope Road
Jal, NM 88252

Section 18:

Lots 1, 2; E/2 NW/4; N/2 NE/4;

Robert Madera Trust
% Bert Madera
524 Antelope Road
Jal, NM 88252

S/2 NE/4;

United States of America
Bureau of Land Management
P. O. Box 27115
Santa Fe, NM 87502

Grazing Lessee:

Robert Madera Trust
% Bert Madera
524 Antelope Road
Jal, NM 88252

Lots 3, 4; E/2 SW/4; SE/4;

Billie McKandles Fortner
% Mary Nell McKandles Hale
1033 Park Center Street
Benbrook, TX 76126

Section 19:

Lots 1, 2, 3; E/2 NW/4; NE/4 SW/4; NE/4;

Robert Madera Trust
% Bert Madera
524 Antelope Road
Jal, NM 88252

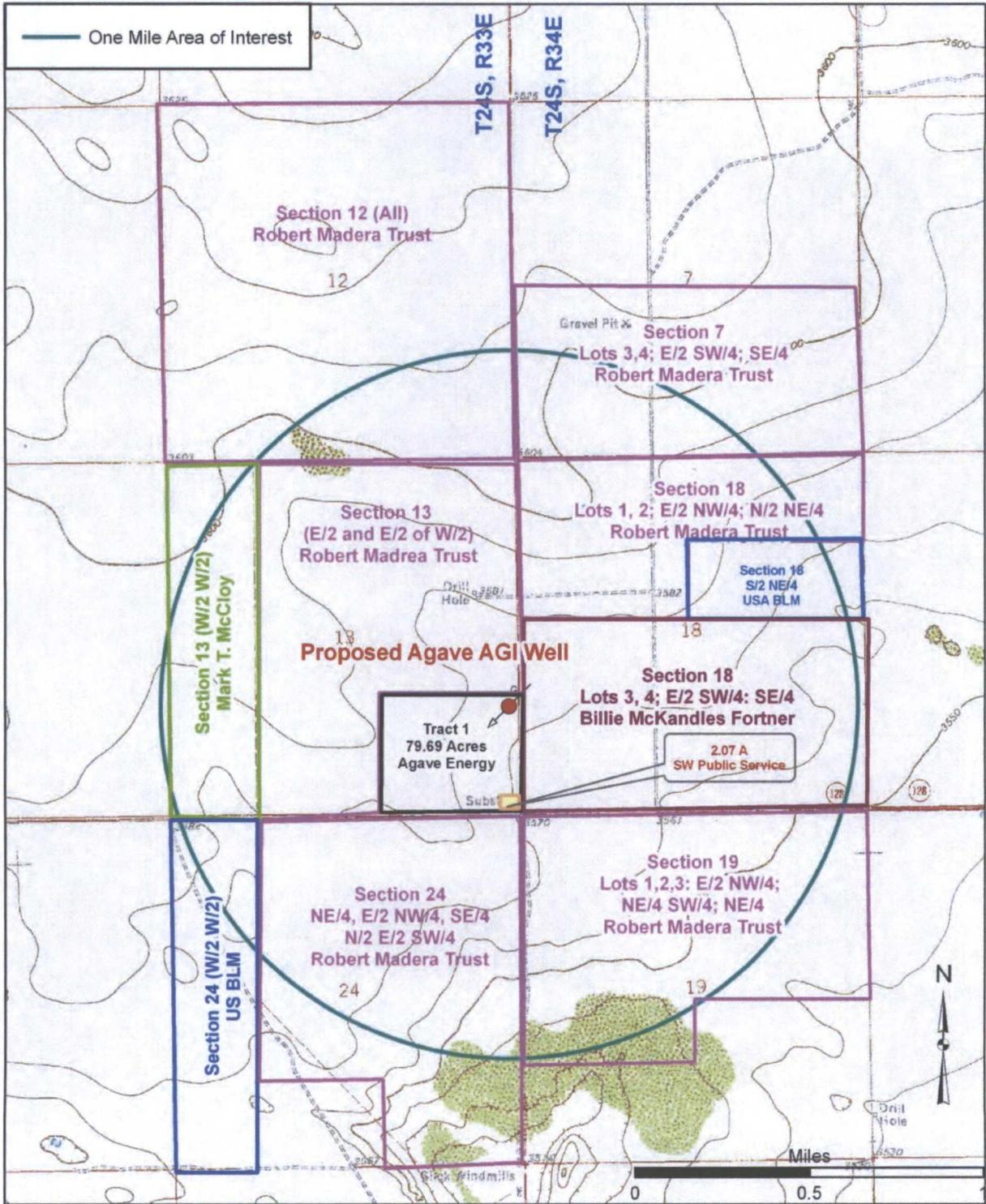


Figure C1. Land Owners in One-Mile Area Around Proposed Agave Red Hills AGI #1 Well

TABLE C-3

**LEASE HOLDERS WITHIN ONE MILE RADIUS
OF PROPOSED AGAVE RED HILLS AGI #1**

Township 24 South, Range 33 East:
Sections 12, 13, 14, and 24

On May 12, 1953, all the above mentioned sections were included in a "Unit Agreement" titled the "Bell Lake Unit Area". The operator of this unit was Continental Oil Company. This unit area covered 37,177.86 acres. Nothing in the index books at Elliott & Waldren abstract office indicate any change in the lease agreement or size of the unit area.

Kaiser & Francis Oil Company
P. O. Box 21468
Tulsa, OK 74121

Conoco Phillips
505 N. Big Spring Street
Suite # 600
Midland, TX 79701

Township 24 South, Range 34 East:
Sections 7, 18, and 19

All the above mentioned sections are included in the "Bell Lake Unit Area" described above.

Kaiser & Francis Oil Company
P. O. Box 21468
Tulsa, OK 74121

Conoco Phillips
505 N. Big Spring Street
Suite # 600
Midland, TX 79701

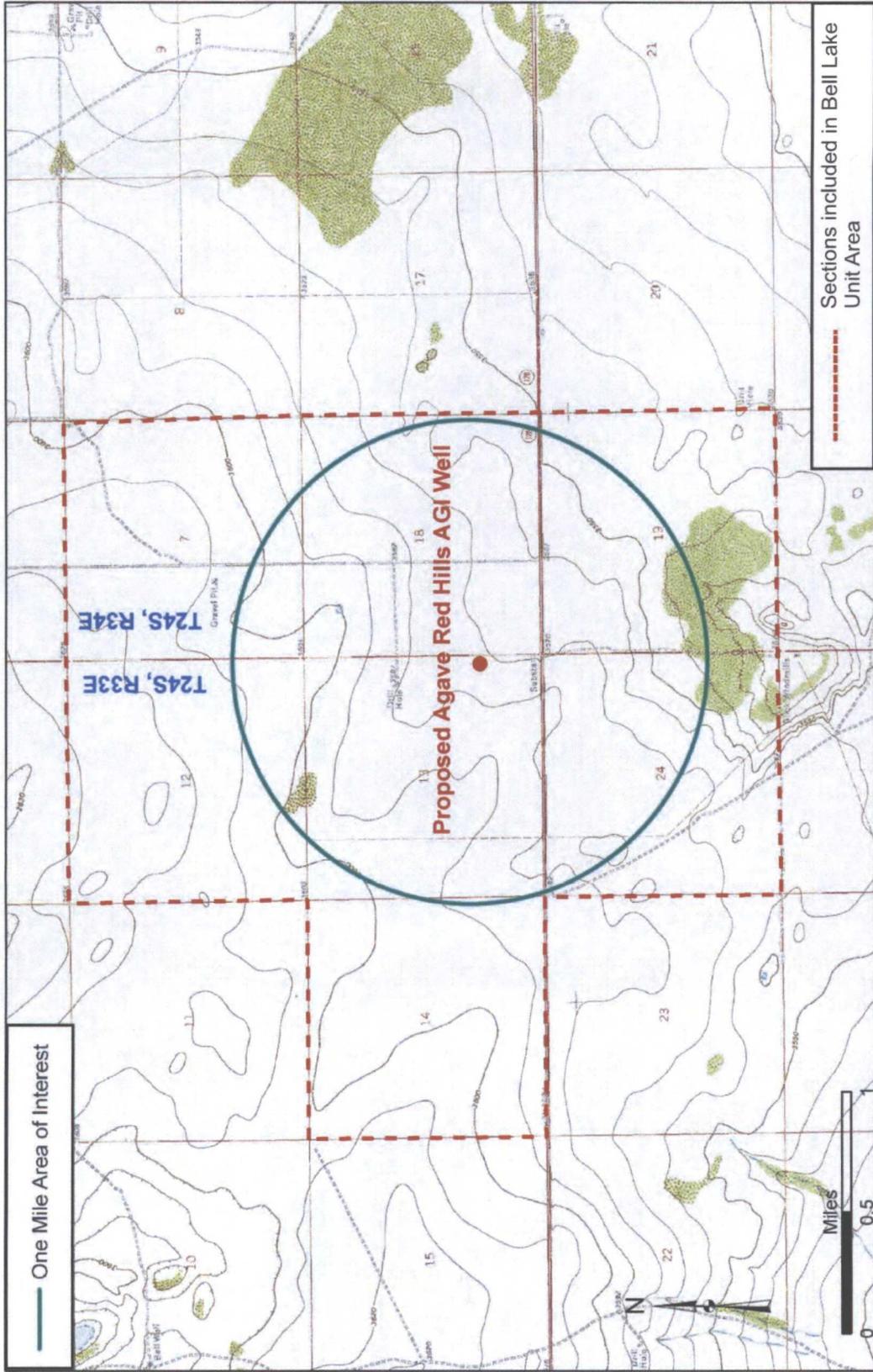


Figure C2. Leases in One-Mile Area Around Proposed Agave Red Hills AGI #1 Well
 (All Sections Shown are Included in the May 12, 1953 "Bell Lake Unit Area", Jointly Held
 by Production by Conoco Phillips and Kaiser & Francis Oil Col.)



TABLE C-4

**BUSINESSES AND/OR STRUCTURES WITHIN ONE MILE RADIUS
OF PROPOSED AGAVE RED HILLS AGI #1**

Proposed Agave Red Hills Gas Processing Plant

Frontier Field Services, LLC
1900 Dalrock
Rowlett, TX 75088

Electrical Sub-station (unmanned)

The sub-station is on a 300' x 300' tract; it contains the normal equipment of an electrical sub-station plus a cement block building approximately 10' x 10'.

Southwestern Public Service Company

414 Nicollet Mall
Minneapolis, MN 55401

There are no other businesses, buildings or structures within the 1 mile radius.

[DATE]

Generic Notified Party
Mailing Address
City, State Zip Code

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

RE: CASE NUMBER XXXXX AGAVE ENERGY COMPANY RED HILLS AGI #1

This letter is to advise you that Agave Energy Company ("Agave") filed the enclosed application on July 20, 2011, with the New Mexico Oil Conservation Division ("NMOCD" or "the Division") seeking authorization to drill an Acid Gas Injection (AGI) well at the proposed Agave Red Hills Gas Processing Plant located approximately 20 miles northwest of Jal, New Mexico. The proposed well will be located 150 feet from the East line and 1,600 feet from the South line of Section 13, Township 24 South, Range 33 East, in Lea County. Agave plans to inject up to 13MMCFD of acid gas and CO₂ from the Plant at a maximum pressure of 2,085 psi into this well into the Cherry Canyon Formation, approximately 6,200 to 6,530 feet below the surface. The proposed well will serve as the disposal well for acid gas and CO₂ which will be produced at the Agave Red Hills Plant.

This application (case number XXXXX) has been set for hearing before the Oil Conservation Commission at [TIME] on [DATE] in Porter Hall at the NMOCD's Santa Fe office located at 1220 South Saint Francis Drive, Santa Fe, New Mexico 87505. You are not required to attend this hearing, but as an owner of an interest that may be affected by Agave's application, you may appear and present testimony. Failure to appear at that time and become a party of record will preclude you from challenging the application at a later date.

A party appearing at the hearing is required by the Commission's rules to file a Pre-Hearing Statement with the NMOCC's Santa Fe office no later than one week prior to the hearing date. This statement must be served on counsel for Agave and on all other parties and should include: your name and the name of your attorney, if any; a concise statement of the case; the names of all witnesses you will call to testify at the hearing; the approximate time you will need to present your case; and an identification of any procedural matters that need to be resolved prior to the hearing.

If you have any questions concerning this application, you may contact Mr. Alberto Gutierrez at (505) 842-8000 at Geolex, Inc. 500 Marquette Avenue NW, Suite 1350, Albuquerque, New Mexico 87102.

Sincerely,
Geolex, Inc.

Alberto A. Gutiérrez, C.P.G.
President
Consultant to Agave Energy Company

Enclosure
AAG/lh

C:\Projects\11-006\Reports\C-108\Appendix C\Final Agave Notice Letter.docx

**AGAVE ENERGY COMPANY
DRAFT PUBLIC NOTICE FOR HEARING
TO BE PUBLISHED IN THE HOBBS NEWS-SUN**

Case No. XXXXX: Application of Agave Energy Company for authority to inject, Lea County, New Mexico. Agave Energy Company requests an order from the NM Oil Conservation Commission authorizing it to inject acid gas and carbon dioxide (CO₂) from the Red Hills Gas Processing Plant into its proposed Red Hills AGI#1 well. The well will be located in Section 13, Township 24 South, Range 33 East, NMPM, in Lea County, New Mexico. Agave Energy Company seeks approval to drill and complete a well for injection of acid gas and CO₂ into the Cherry Canyon Formation approximately from 6200 feet to 6530 feet, and approval of a maximum injection pressure of 2085 psi and a maximum daily injection rate of 13MMCFD. The proposed Red Hills AGI #1 will be located approximately twenty (20) miles northwest of the town of Jal, New Mexico.