

C108 APPLICATION FOR AUTHORIZATION TO INJECT

Prepared for:

**State Of New Mexico
Energy, Minerals And Natural
Resources Department**

**Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, New Mexico 87505**

Prepared by:



BEFORE THE OIL CONSERVATION DIVISION
Santa Fe, New Mexico
Case No.'s14332 & 14333 (Consolidated) Exhibit No. 4
Submitted by:
ENSTOR GRAMA RIDGE STORAGE
AND TRANSPORTATION, LLC
Hearing Date: July 23, 2009

APPLICATION FOR AUTHORIZATION TO INJECT

- I. PURPOSE: _____ Secondary Recovery _____ Pressure Maintenance _____ Disposal Storage
Application qualifies for administrative approval? _____ Yes _____ No
- II. OPERATOR: ENSTOR GRAMA RIDGE STORAGE AND TRANSPORTATION, LLC
ADDRESS: 20329 State Highway 249, Suite 400, Houston, Texas 77070
CONTACT PARTY: Daryl Gee PHONE: 1 (281) 379-7499
- III. WELL DATA: Complete the data required on the reverse side of this form for each well proposed for injection.
Additional sheets may be attached if necessary. *See Attachment III*
- IV. Is this an expansion of an existing project? Yes _____ No
If yes, give the Division order number authorizing the project: R-11611
- 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. *See Attachment V*
- 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. *See Attachment VI*
- VII. Attach data on the proposed operation, including:
1. Proposed average and maximum daily rate and volume of fluids to be injected; *N/A*
2. Whether the system is open or closed; *N/A*
3. Proposed average and maximum injection pressure; *See Attachment VII*
4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and, *N/A*
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.). *N/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. *See Attachment VIII*
- IX. Describe the proposed stimulation program, if any. *N/A*
- *X. Attach appropriate logging and test data on the well. *Well Logs are on file with OCD.*
- *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. *Only one water well falls within the 1-mile radius from the proposed injection well. The chemical analysis of this well is attached (See Attachment XI).*
- 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.
- XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.
- 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: _____ TITLE: _____
SIGNATURE: _____ DATE: _____
E-MAIL ADDRESS: _____
- * 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

III. WELL DATA

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

- (1) Lease name; Well No.; Location by Section, Township and Range; and footage location within the section.
- (2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.
- (3) A description of the tubing to be used including its size, lining material, and setting depth.
- (4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

- (1) The name of the injection formation and, if applicable, the field or pool name.
- (2) The injection interval and whether it is perforated or open-hole.
- (3) State if the well was drilled for injection or, if not, the original purpose of the well.
- (4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.
- (5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

- (1) The name, address, phone number, and contact party for the applicant;
- (2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;
- (3) The formation name and depth with expected maximum injection rates and pressures; and,
- (4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.

Gramma Ridge Federal, 8817 JV-P, #1

Well Data

Section

III

- (1) API # 30-025-30686
- Location: 660' FNL, 1980' FEL Sec. 9, T2S, R34E
- Spudded: 10/14/1989
- Completed: 12/27/1989

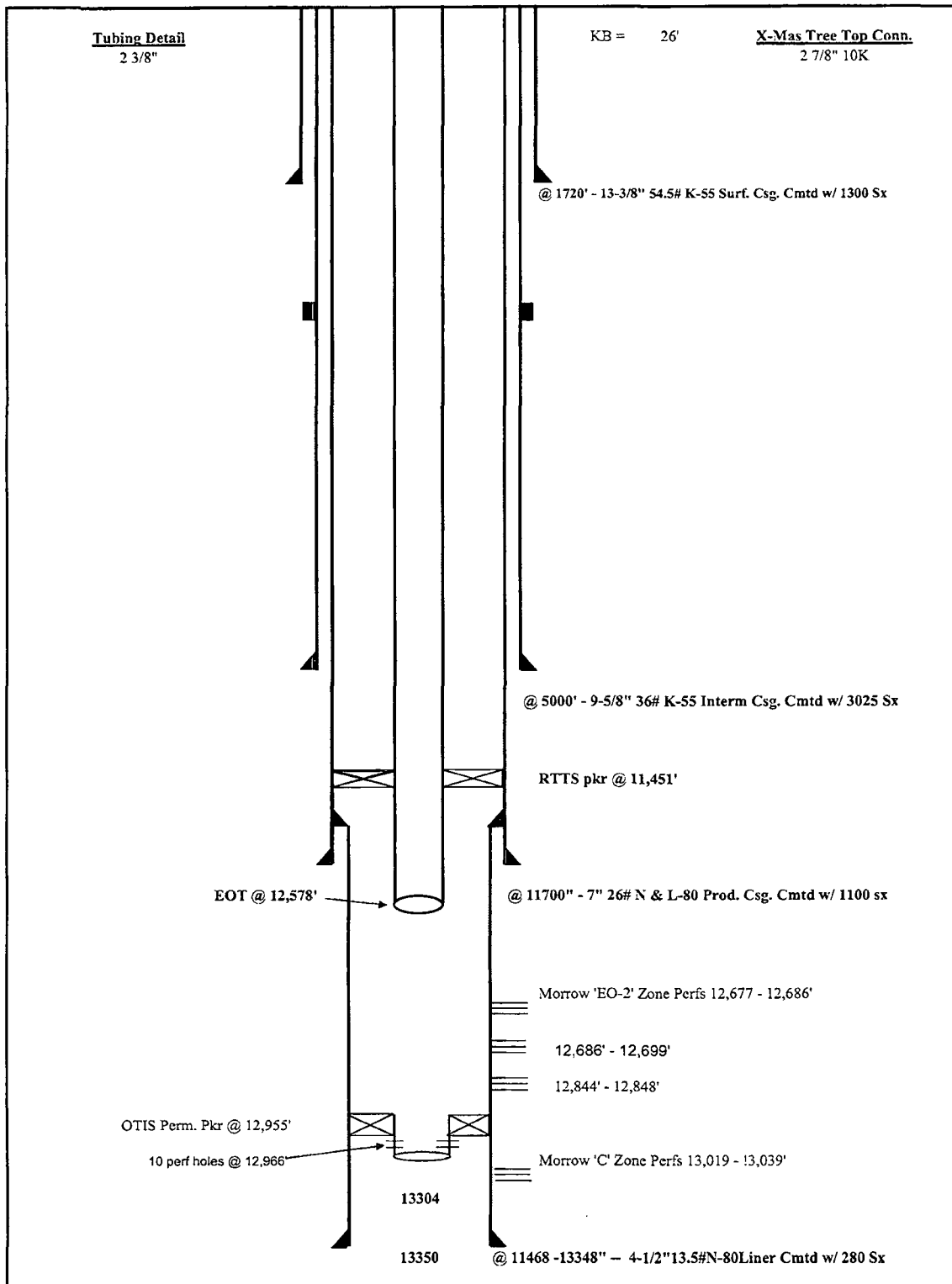
| (2) Casing Record: | Size (in) | Weight (lb/ft) | Grade | Connection | Depth Set (ft) | Hole Size (in) | Cementing Record | Top of Cement |
|--------------------|-----------|----------------|---------|------------|-----------------|----------------|------------------|--|
| | 20" | Unknown | Unknown | | Unknown | | | |
| | 13-3/8" | 54.5 | K-55 | STC & BTC | 1,720' | 17-1/2" | 1,300 sacks | 403 sacks to Surface |
| | 9-5/8" | 36.0 | K-55 | STC | 5,000' | 12-1/4" | 2,025 sacks | 414 sacks to Surface |
| | 7" | 26.0 | N&L 80 | LTC | 11,700' | 8-3/4" | 1,100 sacks | 6,550' Temp Log |
| Liner Record: | 4-1/2" | 13.5 | N-80 | LTC | 11,468'-13,348' | 6-1/8" | 280 sacks | Drill cement to 11,468' |
| | | | | | | | | Lindsey Model R liner hanger with 6' tie back sleeve @ 11,468' * |


- (3) Post work over Tubing: 5" 18.0 P-110 SLX or equiv. 11,435'
- (4) Post work over Packer: 7" Baker FA or equiv. SLX or equiv. 11,435'

*Lindsey Model R liner hanger is specified in Sun Petroleum's 1989 drilling plan but there is no verification on daily drilling reports confirming actual model used.

III

- (1) Injection Formation: Morrow Clastics
- (2) Post work over Perforations: 12,844-48' Morrow "A"
13,019-39' Morrow "C"
- (3) Well originally drilled for production of Natural Gas
- (4) Other perforated intervals: 12,677-99' Morrow Lime
To be squeeze cemented with 50 sacks cement
- (5) Next higher oil or gas zone: 12,677-99' Morrow Lime
Next lower oil or gas zone: None known



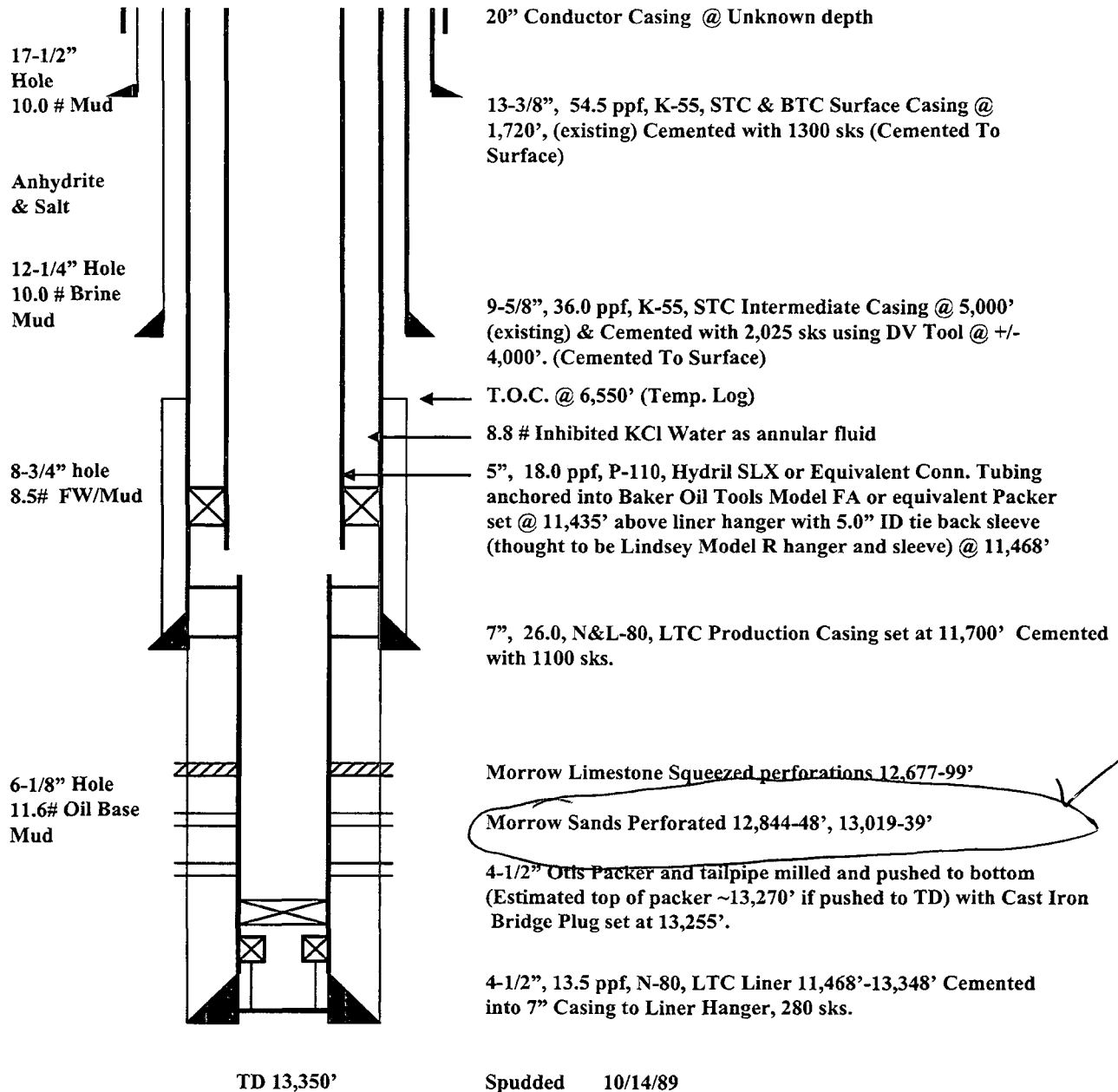
| | | | |
|---------|--|--------------------------|-------------------|
| Revised | PRESENT COMPLETION | | Drawn <u>TJW</u> |
| | LEASE: 8817 Grama Ridge Fed. | #1 | <u>11/28/2001</u> |
| | FIELD: Grama Ridge Morrow | | Approved _____ |
| | LOCATION: 660 FNL 1980 FEL Sec. 9 T22S R34E | | Date _____ |
| | COUNTY: Lea | STATE: New Mexico | |
| | PRODUCING FORMATION: Morrow | | |
| |  BTA Oil Producers | | |

Gramma Ridge Federal, 8817 JV-P, #1

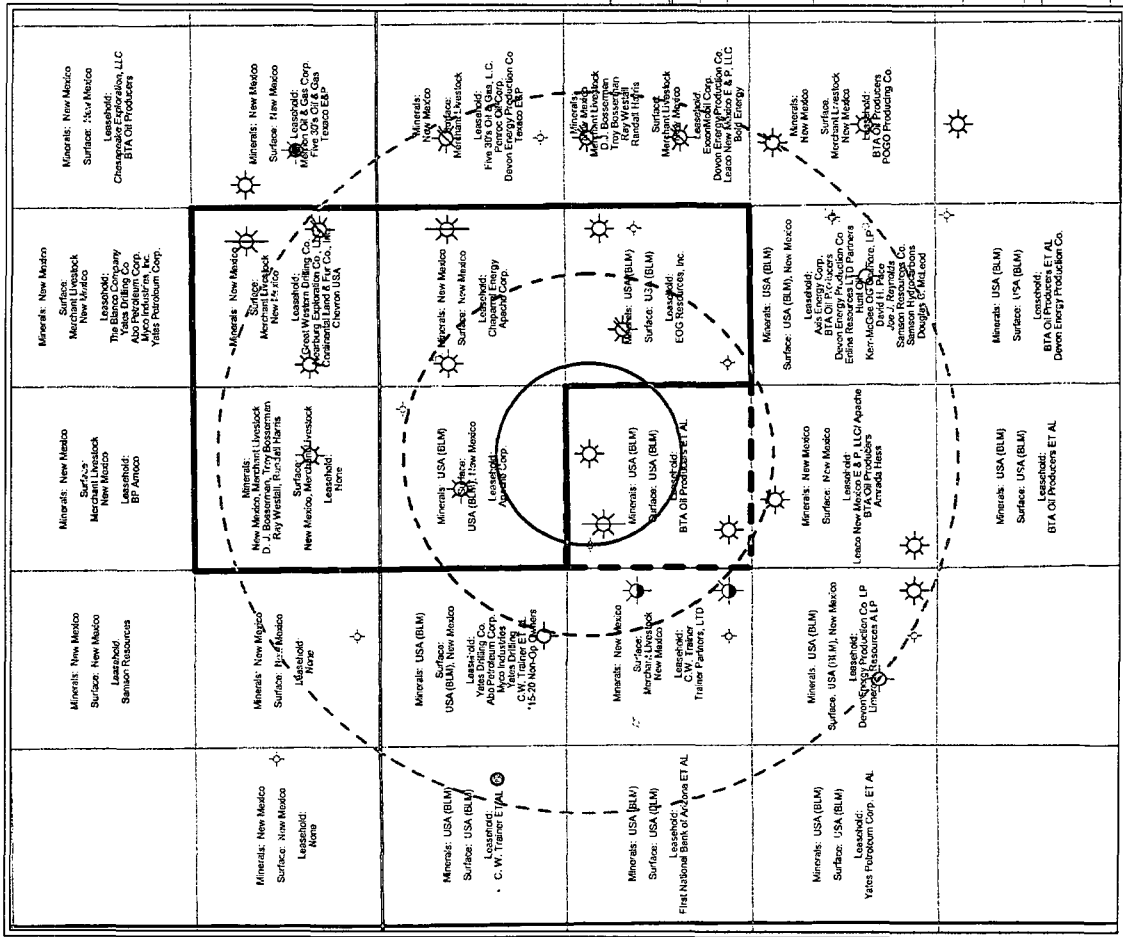
API # 30-025-30686

660' FNL, 1980' FEL Sec. 9, T22S, R34E

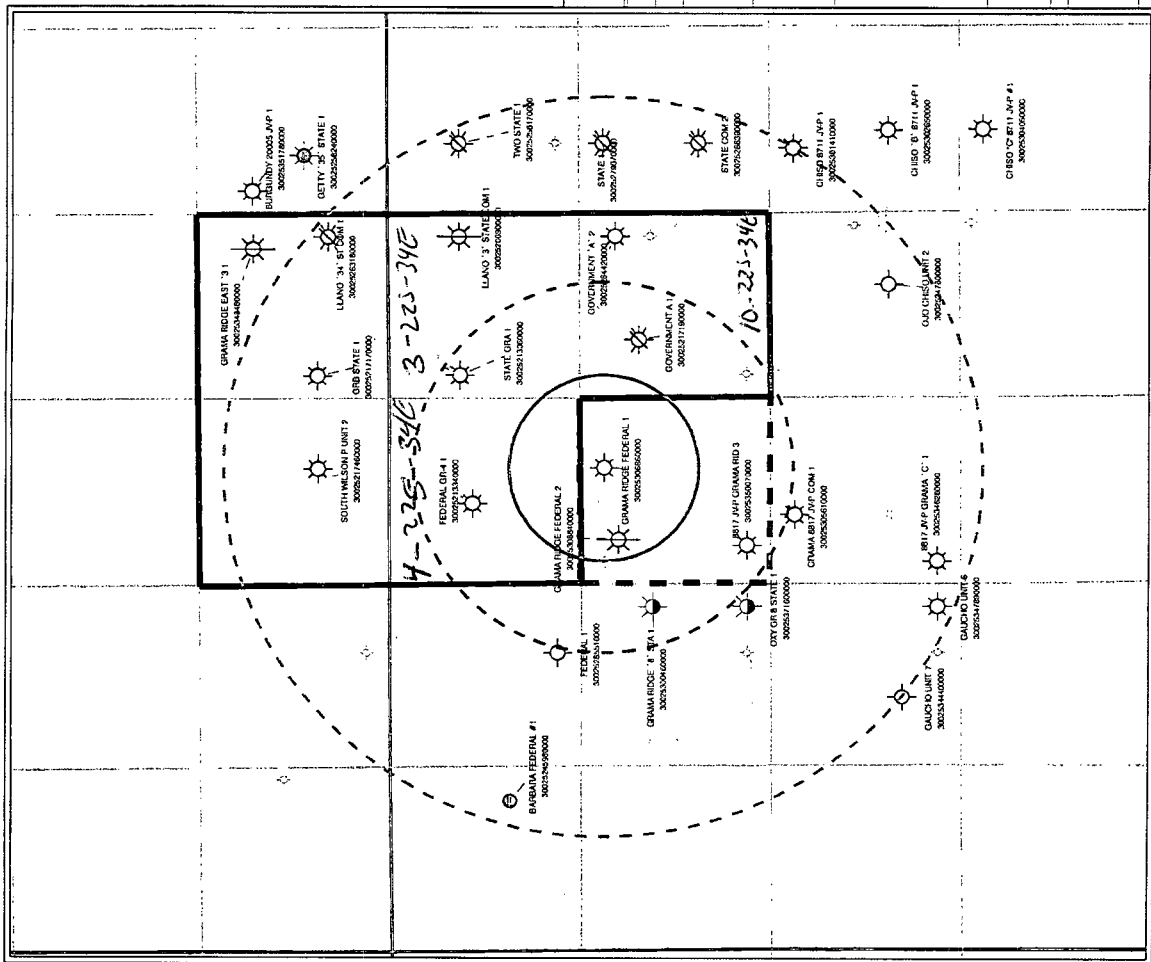
Following Conversion to Natural Gas Storage



Spudded 10/14/89
Released Rig 12/6/89
Completed 12/27/89



FILE: 1614700087562.PDF



ENSHOR

GRAMMA RIDGE PROJECT

WELLS

POSTED WELL DATA

OK/BLAY

FILE: GRAMMA RIDGE OVERLAY

GRAMMA RIDGE
OVERLAY
WELLS
MULTI-PROJ
MULTI-PROJ

WELL SYMBOLS

- OK Well
- Gas Well
- Dry Well
- Abandoned
- Plugged & Abandoned Gas Well
- Oil & Gas Well
- Dry Hole, With Show of Gas
- Service Well
- Jammed
- Abandoned Well

Red solid circle: 17" diameter
Green dashed circle: 2" inner radius
Green solid circle: 2" inner radius

By: Vicki Devine

0 5,000
FEET

April 21, 2008

| Name | UWI/API | Type | Status | Location | | Date | Activity | Depth TD | Record of Completion | | | | |
|------------------------------------|-------------------------------------|--------|--------|----------|-----|------|----------|-----------|--|------------------|------------------|------------------|---------------------------|
| | | | | Twn | Rng | | | | Sec | Spot | Base | Type | Formation |
| Grama Ridge Federal, 8817 JV-P, #1 | 30-025-30686-0000 | GAS | Active | 22S | 34E | 9 | NW NE | Spud date | 13,350 | | | | |
| | | | | | | | | Dec-89 | Perforations - RFT measured Morrow "A" as depleted - No stimulation recorded in Morrow "C" - Morrow "C" at virgin pressure | 13,019 | 13,039 | Active | Morrow "C" |
| | | | | | | | | Jun-95 | Added perforations - Isolated from Morrow "C" with OTIS perm packer @12,955' | 12,677 | 12,686 | Active | Morrow Lime |
| | | | | | | | | Jul-97 | Added perforations to tailpipe in packer @12,955' | 12,955 | 12,955 | Active | Morrow "C" |
| | | | | | | | | May-00 | Added perforations/Co-mingled all zones | 12,686 12,844 | 12,689 12,848 | Active Active | Morrow Lime Morrow "A" |
| | | | | | | | | May-90 | Spud date | 13,375 | | | |
| | | | | | | | | Jul-90 | Perforations | 12,724 12,905 | 12,766 12,922 | Active Active | Morrow Lime Morrow "A" |
| | | | | | | | | Oct-92 | Added perforations | 12,985 13,051 | 12,989 13,056 | Active Active | Morrow "B" Morrow "C" |
| | | | | | | | | Sep-95 | Work over and isolation - Morrow producing water - Isolated Morrow with CIBP @ 12,860' - Began production of Morrow Lime only | 12,860 | 12,860 | BP | above Morrow "A" |
| | | | | | | | | Nov-02 | Well Shut-in | | | | |
| Mar-06 | Well TA - CIPG above Bone Spring | 12,650 | 12,650 | | | | | | | | | | |

Attachment VII

3. Proposed Average Injection Surface Pressure = 3850 psi
Proposed Maximum Injection Surface Pressure = 5000 psi

Geological Summary

The Morrow Clastics in the Grama Ridge Storage Unit comprise four stratigraphic sequences, commonly referred to as Morrow 'A' through 'D'. Within the Unit sandstones can be developed in all zones, however porosity and permeability, and even the presence or absence of sand, vary widely between wells.

The sandstones in the Morrow at Grama Ridge were deposited during base-level rise into incised valleys cut into the marine Morrow shale during the previous sea level low-stand. Flooding of the valleys resulted in dip-oriented channel-fill sandstones, along with more strike-oriented deltaic and estuarine-marine sandstones. The sandstones are 10 to 30 feet thick, discontinuous, and less than one mile wide.

In the Grama Ridge Federal #1 (GR Fed #1) in NW NE Section 9-T22S-R34E, the gas storage interval includes the Morrow 'A' through the 'D' zones from 12,754 feet to 13,258 feet (see cross section in Attachment 8). Within the storage interval only the Morrow 'A' and Morrow 'C' are presently perforated (12,844-12,848; 13,019-13,039, respectively). The GR Fed #1 has no significant sand present in the Morrow 'B', and the Morrow 'D', while having about 14 feet of sand, appears to have only an average 3% porosity.

A summary of the target injection intervals in GR Fed #1 follows:

Morrow 'A':

- Depth: 12821-12865
- Zone thickness: 44.3 feet
- Lithology: three sandstone units 10-18 feet thick separated by shales
- Gross 'A' Sandstone: 10.5 feet (using a normalized GR cutoff of 50 API)
- Net 'A' Sandstone: 5 feet (Gross SS with $\geq 6\%$ Porosity)

Morrow 'C':

- Depth: 12975-13057
- Zone thickness: 82.6 feet
- Lithology: stacked sandstones with interbedded silts and shales; main sandstone is approximately 30 feet thick.
- Gross 'C' Sandstone: 36.75 feet (using a normalized GR cutoff of 50 API)
- Net 'C' Sandstone: 24.5 feet (Gross SS with $\geq 6\%$ Porosity)

The two (2) major groundwater aquifers found in the region of GR Fed #1 are the Ogallala Formation/Aquifer and the Capitan Aquifer. The Ogallala is the primary aquifer in the southern portions of Lea County. The Ogallala consists of sand, silt, clay, and gravel. It is approximately 250 feet thick, and thins toward the southern portion of the County where GR Fed #1 is located. The Ogallala Aquifer is used for municipal, domestic, livestock, irrigation, oil and gas production, and other commercial and industrial purposes. Groundwater in the Ogallala Aquifer generally is of good quality, usually suitable for potable purposes. It can occur under unconfined conditions at depths of 50 feet or less, but typical depths of water wells in the Ogallala are 100 to 500 feet below ground surface (bgs). Water supply well GR-1/WW-1 installed at the Grama Ridge compressor station in 2007 is assumed to be completed in the Ogallala. The boring was advanced to a total depth of 109 ft., and groundwater was encountered at a depth of 62 ft. Attached is a summary report of an analysis of groundwater sampled from the well after it was completed.

The Capitan Aquifer also is an important source of groundwater in the southern portion of Lea County. The Capitan consists of dolomite and limestone strata that are part of the Capitan Reef Complex. Water quality from the Capitan generally is very poor. However, it is used extensively for mining, oil and gas production, livestock watering, and some industrial and domestic purposes. The total depth of wells in the Capitan generally is 500 to 1,000 feet.

There are no known water sources underlying the Morrow Clastics at this location.



GRAMA RIDGE PROJECT

STRUCTURE MAP

TOP MORROW 'A'

POSTED WELL DATA

Morrow Blue (SS) (FEET)

CONTOURS

STRUCTURE - TOP MORROW 'A'

STRAUX MRY, BLUE 2 FAULTS VVO.GRD

Contour Interval = 50

WELL SYMBOLS

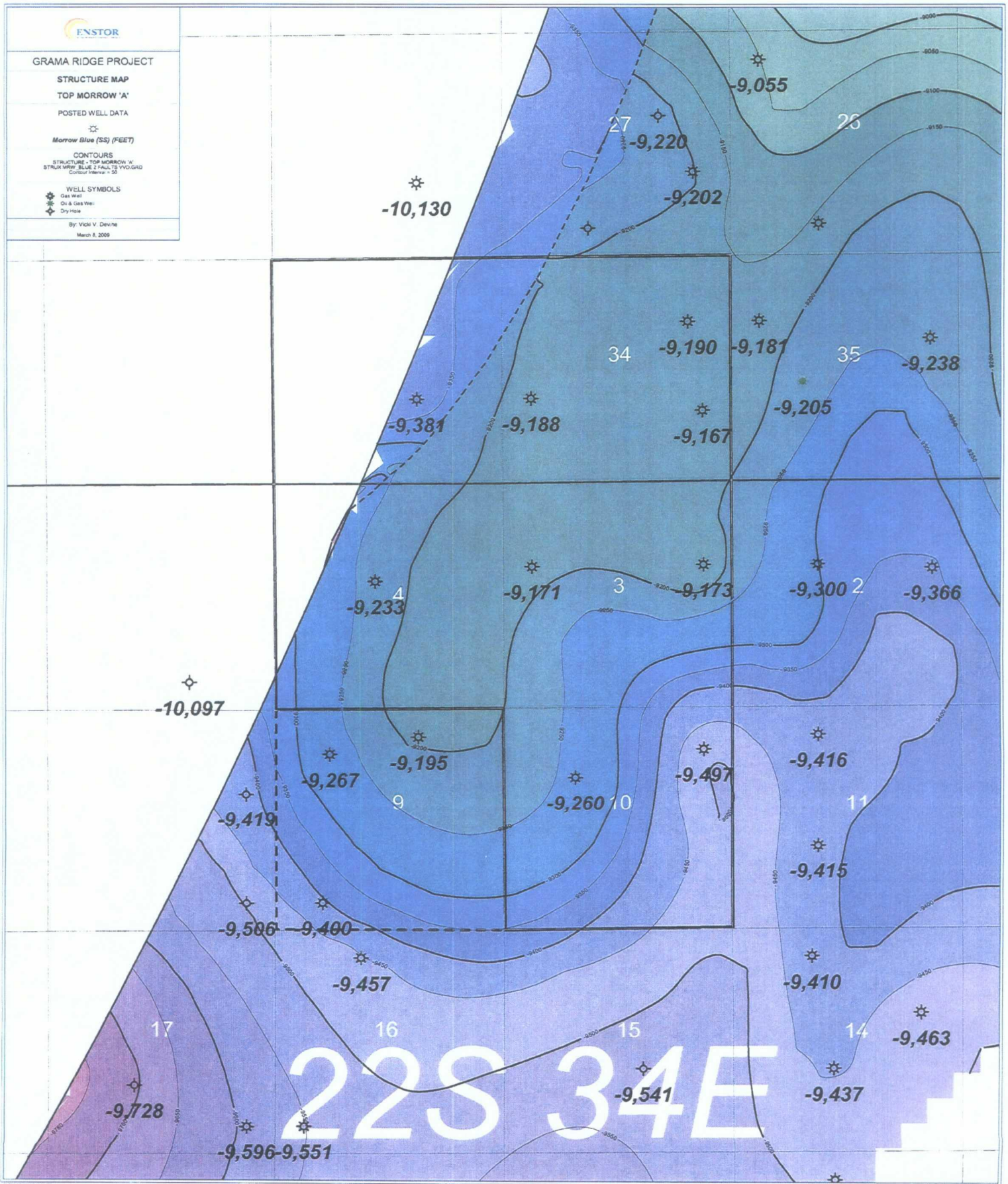
Gas Well

Oil & Gas Well

Dry Hole

By: Vicki V. Desha

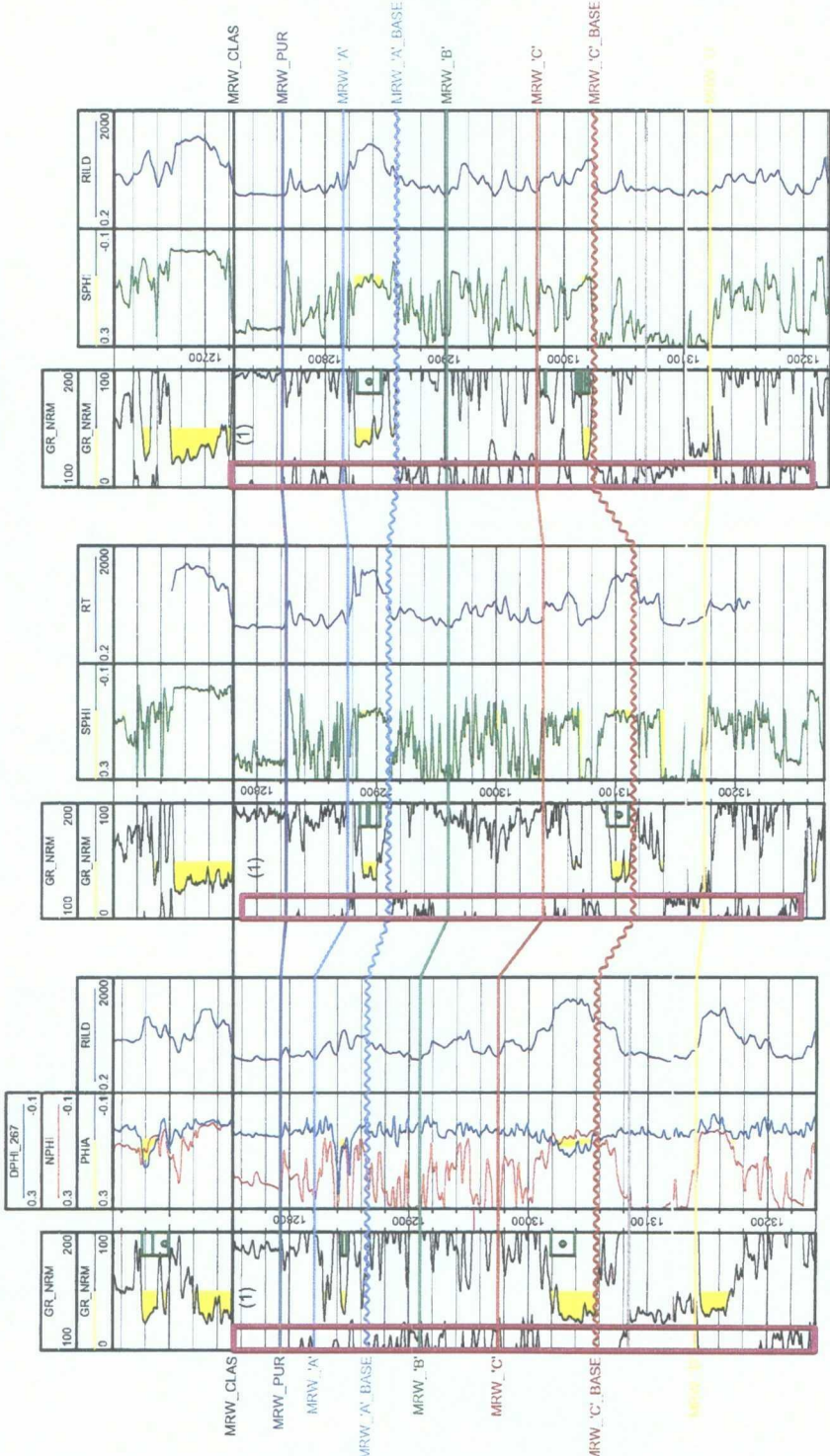
March 8, 2009



BTA #1
GRAMA RIDGE FEDERAL 1
22S 34E Sec 9 NW NE

GRU #4
FEDERAL GR-4 1
22S 34E Sec 4 SE NW

GRU #1
STATE GRA 1
22S 34E Sec 3 SW NW



(1) Show: STORAGE INTERVAL 12754-13258
(1) Show: BLM STORAGE INTERVAL 12788-13255
(1) Show: NM STORAGE INTERVAL 12722-13208



GRAMA RIDGE PROJECT
MORROW CLASTICS
STORAGE INTERVALS
MORROW LS TO MORROW 'D'

Horizontal Scale = 1005.5
Vertical Scale = 100.0
Vertical Exaggeration = 10.1x



By Vicki V. Devine
April 23, 2009 8:11 AM

HS=1005

FILE: P:\A4328388\1137_A43 STORAGE INTERVALS & CROSS SECTION.CMP

P.O. BOX 98
MIDLAND, TX. 79702
PHONE (432) 683-4521

Martin Water Laboratories, Inc.

709 W. INDIANA
MIDLAND, TEXAS 79701
FAX (432) 682-8819

RESULT OF WATER ANALYSES

TO: Mr. Larry Khromer
20333 State Hwy 249, Suite 400, Houston, TX 77070

LABORATORY NO. 607-21
SAMPLE RECEIVED 5-31-07
RESULTS REPORTED 6-4-07

COMPANY Enstor LEASE Gramma Plant

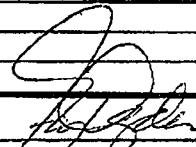
FIELD OR POOL _____
SECTION _____ BLOCK _____ SURVEY _____ COUNTY Lea STATE NM

SOURCE OF SAMPLE AND DATE TAKEN:
NO. 1 Drinking water - taken 5-31-07.
NO. 2 Maximum contents for drinking water as recommended by the Texas Dept. of Health.
NO. 3 _____
NO. 4 _____

REMARKS:

| CHEMICAL AND PHYSICAL PROPERTIES | | | | |
|---|--------|-------|-------|-------|
| | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
| Specific Gravity at 80° F. | 1.0020 | | | |
| pH When Sampled | | | | |
| pH When Received | 7.45 | | | |
| Bicarbonate as HCO ₃ | 195 | | | |
| Supersaturation as CaCO ₃ | | | | |
| Undersaturation as CaCO ₃ | | | | |
| Total Hardness as CaCO ₃ | 168 | | | |
| Calcium as Ca | 48 | | | |
| Magnesium as Mg | 12 | | | |
| Sodium and/or Potassium | 34 | | | |
| Sulfate as SO ₄ | 30 | 300 | | |
| Chloride as Cl | 36 | 300 | | |
| Iron as Fe | 0.15 | 0.30 | | |
| Barium as Ba | | | | |
| Turbidity, Electric | | | | |
| Color as Pt | | | | |
| Total Solids, Calculated | 355 | 1,000 | | |
| Temperature °F. | | | | |
| Carbon Dioxide, Calculated | | | | |
| Dissolved Oxygen | | | | |
| Hydrogen Sulfide | 0.0 | | | |
| Resistivity, ohm-cm at 77° F. | 24.20 | | | |
| Suspended Oil | | | | |
| Filtrable Solids as mg/l | | | | |
| Volume Filtered, ml | | | | |
| Nitrate, as N | 4.0 | 10.0 | | |
| Results Reported As Milligrams Per Liter | | | | |
| Additional Determinations And Remarks <u>Based on the determinations performed above, this water shows salt levels that comply with State Health Department standards for drinking water. However, coliform bacteria was present in the submitted sample and therefore this water should not be consumed.</u> | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Form No. 3

By 
Greg Ogden, B.S.



Martin Water Laboratories, Inc.

Analysts & Consultants since 1953
Bacterial & Chemical Analysis

To: Mr. Larry Khromer
20333 State Hwy 249, Suite 400
Houston, TX 77070

Laboratory No. B607-31
Sample received 5-31-07
Sample reported 6-4-07

Company: Enstor
County: Lea, NM
Field:
Lease: Grama Plant

Subject: To determine the presence or absence of coliform bacteria.

Method: USEPA Equivalent Presence/Absence Method 8364
100 ml of sample is combined with premeasured and packaged media broth, incubated 48 hours at 35°C, and examined for yellow color, which indicates the presence of coliforms, or a red color, indicating a negative test.

Source of sample and date taken: Drinking water - taken 5-31-07.

Found (Present)

Not Found (Absent)

✓

Remarks: These results show coliform bacteria to be present in the submitted water sample and therefore this water would not be acceptable for human consumption.

Greg Ogden, B.S.