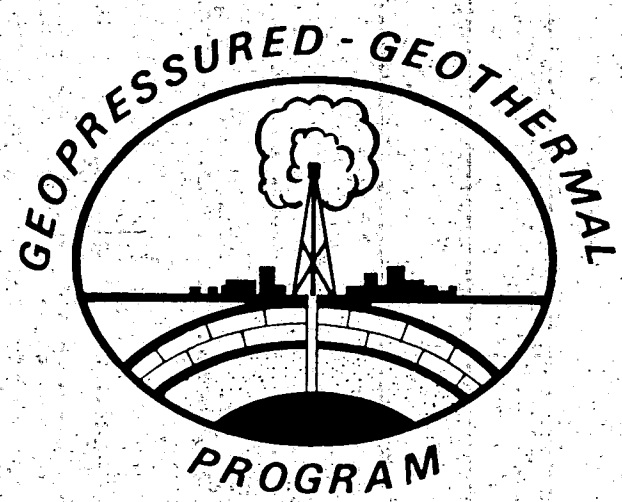

TESTING GEOPRESSURED GEOTHERMAL RESERVOIRS IN EXISTING WELLS

U.S. DEPARTMENT OF ENERGY
CONTRACT NO. DE-AC08-80ET27081

DETAILED COMPLETION PROGNOSIS

FOR GEOPRESSURED - GEOTHERMAL WELL OF OPPORTUNITY

PROSPECT #2

MARTIN - CROWN ZELLERBACH WELL NO. 2

EATON OPERATING COMPANY, INC.
3100 EDLOE, SUITE 205
HOUSTON, TEXAS 77027
713-627-9764

DISCLAIMER

TESTING GEOPRESSURED - GEOTHERMAL RESERVOIRS IN EXISTING WELLS

DETAILED COMPLETION PROGNOSIS FOR GEOPRESSURED - GEOTHERMAL WELLS OF OPPORTUNITY

MARTIN CROWN ZELLERBACH WELL NO. 2

DOE CONTRACT NO.
DE-AC08-80ET-27081

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3100 Edloe
Houston, Texas 77027
(713) 627-9764

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GEOPRESSURED - GEOTHERMAL WELLS OF OPPORTUNITY

PROSPECT NO. 2

EATON OPERATING COMPANY - D.O.E. - MARTIN EXPLORATION COMPANY

CROWN ZELLERBACH NO. 2

LIVINGSTON PARISH, LOUISIANA

1.0 INTRODUCTION

Eaton Operating Company, Inc. recommends D.O.E. funding for a geopressured-geothermal test of Martin Exploration Company's Crown Zellerbach Well No. 2 under the Wells of Opportunity program. Total estimated cost to complete the test well, complete a saltwater disposal well and test the well is $3,401,000. An optional test involving a conventional workover plugback with a rig on location would cost an estimated $715,000.

This geopressured-geothermal WOO prospect was originally drilled by Martin Exploration Company to a total depth of 17,000' with 9-5/8" intermediate casing set at 14,109'. The well was plugged to facilitate the planned re-entry. Estimated bottomhole pressure at an intermediate formation depth of 16,736' is 12,010 psi. A mud weight of 13.8 lb/gal. was used during the drilling of the proposed test zone. Estimated bottom hole temperature is 297°F and maximum estimated salinity is 16,000 ppm. Assuming saturation, the gas content is estimated to be 51 SCF/bbl.

Completion operations will consist of cleaning out the well to total depth, running a full string of 7 inch casing and testing the Tuscaloosa Trend of Upper Cretaceous Age from approximately 16,718 feet to 16,754 feet.

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3100 Edloe
Houston, Texas 77027
(713) 627-9764

Work on the project should begin in March, 1981, and be completed by the end of July, 1981.

2.0 SUMMARY

A geopressured-geothermal test of Martin Exploration Company's Crown Zellerbach Well No. 2 will be conducted in the Tuscaloosa Trend. The Crown Zellerbach Well No. 1 will be converted to a saltwater disposal well for disposal of produced brine.

The well is located in the Satsuma Area, Livingston Parish, Louisiana. Eaton proposes to test the Tuscaloosa by perforating the 7 inch casing from 16,718 feet to 16,754 feet. The reservoir pressure at an intermediate formation depth of 16,736 feet is anticipated to be 12,010 psi and the temperature is anticipated to be 297°F. Calculated water salinity is 16,000 ppm. The well is expected to produce a maximum of 16,000 barrels of water a day with a gas content of 51 SCF/bbl.

Eaton will re-enter the test well, clean out to 17,000 feet, run production casing and complete the well. The disposal well will be re-entered and completed in the 9-5/8 inch casing for disposal of produced brine. Testing will be conducted similar to previous Eaton annular flow WOO tests. An optional test from 16,462 feet to 16,490 feet may be performed after the original test and will require a workover with a rig on location to perform the plugback.

The surface production equipment utilized on previous tests will be utilized on this test. The equipment has worked satisfactorily and all parties involved in the testing are familiar with its operation. Weatherly Engineering will operate the test equipment.

The Institute of Gas Technology (IGT) and Mr. Don Clark will handle sampling, testing and reservoir engineering evaluation, respectively. Wireline work required will be awarded on basis of bid evaluation.

At the conclusion of the test period, the D.O.E. owned test equipment will be removed from the test site, the test and disposal wells plugged and abandoned and the sites restored to the satisfaction of all parties.

3.0 LEGAL AGREEMENTS

This section contains copies of the signed agreements with Martin Exploration Company and Crown Zellerbach.

EATON OPERATING COMPANY, INC.
3100 Edloe, Suite 205
Houston, Texas 77027

January 19, 1981

Martin Exploration Company
3501 N. Causeway Boulevard
Suite 901
Metairie, Louisiana 70002

Attention: Mr. Charles Romano

Re: Martin Exploration Company
Crown Zellerbach Corporation
Well No. 2
Sections 19 and 20, T6S-R5E
Livingston Parish, Louisiana

Gentlemen:

Subject to approval of the United States Department of Energy, Eaton hereby agrees to purchase all of the right, title and interest, inclusive of all geological history, log data and salvage rights, owned by Martin in the following described well, to-wit:

Martin Exploration Company-Crown Zellerbach Well No. 2, as above described, for the sum certain of SIXTY THOUSAND ($60,000.00) Dollars.

Upon payment of said sum Martin, its legal representatives, successors and assigns shall have no further interest in said described well.

Upon completion of certain geothermal-geopressure testing, Eaton shall clean up and restore the location, pursuant to Eaton's agreement with the landowner, Crown Zellerbach.

Martin shall be the sole corporation liable to fairly and equitably distribute the payment made by Eaton to other working interest owners, if any, and Martin herein agrees to hold Eaton harmless from such distribution, if any, by Martin.

Attached hereto and marked Exhibit I and Exhibit II, are certain documents incorporated herein as if fully written in this agreement.

If the above conforms to your understanding of this agreement, please sign and return four copies to us.

Sincerely,

EATON OPERATING COMPANY, INC.

BY: B A Eaton
B. A. EATON, President

ACCEPTED AND AGREED TO this
19th day of January, 1981.

MARTIN EXPLORATION COMPANY

BY: Charles Romano
CHARLES ROMANO
Senior Vice President-Legal

EXHIBIT I

TERMS AND CONDITIONS OF PURCHASE ORDER

1. INSPECTION AND ACCEPTANCE — Inspection and acceptance will be at destination, unless otherwise provided. Until delivery and acceptance, and after any rejections, risk of loss will be on the Contractor unless loss results from negligence of the Purchaser.

2. VARIATION IN QUANTITY — No variation in the quantity of any item called for by this contract will be accepted unless such variation has been caused by conditions of loading, shipping, or packing, or allowances in manufacturing processes, and then only to the extent, if any, specified elsewhere in this contract.

3. DISCOUNTS — Discount time will be computed from date of delivery at place of acceptance or from receipt of correct invoice at the office specified by the Purchaser, whichever is later. Payment is made, for discount purposes, when check is mailed.

4. FOREIGN SUPPLIES — This contract is subject to the Buy American Act (41 CFR-1-6.10405).

5. CONVICT LABOR — In connection with the performance of work under this contract, the Supplier agrees not to employ any person undergoing sentence of imprisonment except as provided by (41 CFR-1-11.204).

6. OFFICIALS NOT TO BENEFIT — No member of, or delegate to, Congress, or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

7. COVENANT AGAINST CONTINGENT FEES — The Supplier warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon any agreement or understanding for a commission, percentage, brokerage, or contingent fees, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Supplier for the purpose of securing business. For breach or violation of this warranty the Purchaser shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration, or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

8. FEDERAL, STATE AND LOCAL TAXES — Except as may be otherwise provided in this contract, the contract price includes all applicable Federal, State, and local taxes and duties in effect on the date of this contract but does not include any taxes from which the Purchaser, the Supplier on this transaction is exempt.

9. Goods must be shipped as per instructions; otherwise any extra handling charge will be billed back to seller.

Approved By: _____

Title: _____

Date: _____

EXHIBIT II

ADDITIONAL
TERMS AND CONDITIONS OF PURCHASE ORDER

Except where the word "Contractor" is used, substitute the word "Subcontractor", and where the word "Government is used, substitute the word "Purchaser".

Applies to Subcontracts or purchase orders which exceed $2,500

1. "Employment of the Handicapped" (41-CFR-1-12.904)

Applies to Subcontracts or purchase orders which exceed $10,000

1. "Notice and Assistance Regarding Patent and Copyright Infringement" (41-CFR-9-9.104)
2. "Utilization of Small Business Concerns" (41-CFR-1-1.710-3)
3. "Utilization of Labor Surplus Area Concerns" (41-CFR-1-1.805-3)
4. "Utilization of Minority Business Enterprises" (41-CFR-1-1.1310.2)
5. "Equal Opportunity" (41-CFR-1-12.803.12)
6. "Disabled Veterans and Veterans of the Vietnam Era"
7. "Termination for Convenience of the Government"(41-CFR-1-8.705-1)
8. "Pricing Adjustment"(41-CFR-1-7.102-20)
9. "Walsh Healy Public Contracts Act"(41-CFR-1-12.605)

Applies to Subcontracts or purchase orders which provide for the performance of Service

1. "Contract Work Hours and Safety Standard Act - Overtime Compensation" (41-CFR-1-12.303)
2. "Service Contract Act of 1965 - As Amended" (41-CFR-1-12.904)

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2. "Authorization and Consent" (41-CFR-9-9.102-1)
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4. "Audit and Record" (41-CFR-1-3.814.2)
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6. "Price Reduction for Defective Cost or Pricing Data" (41-CFR-1-3.814-1)
7. "Notice of Labor Disputes"

ATTACHMENT 2

EATON OPERATING COMPANY, INC.
3100 Edloe, Suite 205
Houston, Texas 77027

January 19, 1981

Martin Exploration Company
3501 N. Causeway Boulevard
Suite 901
Metairie, Louisiana 70002

Attention: Mr. Charles Romano

Re: Martin Exploration Company
Crown Zellerbach Corporation
Well No. 1
Section 19 and 20, T6S-R5E
Livingston Parish, Louisiana

Gentlemen:

Subject to the approval of the United States Department of Energy, Eaton hereby agrees to purchase all of the right, title and interest, inclusive of all geological history, log data and salvage rights, owned by Martin in the following described well, to-wit:

Martin Exploration Company-Crown Zellerbach Corporation Well No. 1, as above described, for the sum certain of EIGHTY-FIVE THOUSAND ($85,000.00) Dollars.

Upon payment of said sum Martin, its legal representatives, successors and assigns shall have no further interest in said described well.

Upon completion of certain geothermal-geopressure testing, Eaton shall clean up and restore the location, pursuant to Eaton's agreement with the landowner, Crown Zellerbach.

Martin shall be the sole corporation liable to fairly and equitable distribute the payment made by Eaton to other working interest owners, if any, and Martin herein agrees to hold Eaton harmless from such distribution, if any, by Martin.

Attached hereto and marked Exhibit I and Exhibit II, are certain documents incorporated herein as if fully written in this agreement.

If the above conforms to your understanding of this agreement, please sign and return four copies to us.

Sincerely yours,

EATON OPERATING COMPANY, INC.

BY: B A Eaton
B. A. EATON, President

ACCEPTED AND AGREED TO this

19th day of January, 1981

MARTIN EXPLORATION COMPANY

BY: Charles Romano
CHARLES ROMANO
Senior Vice President-Legal

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6. OFFICIALS NOT TO BENEFIT — No member of, or delegate to, Congress, or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

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9. Goods must be shipped as per instructions; otherwise any extra handling charge will be billed back to seller.

Approved By: _____

Title: _____

Date: _____

EXHIBIT II

ADDITIONAL TERMS AND CONDITIONS OF PURCHASE ORDER

Except where the word "Contractor" is used, substitute the word "Subcontractor", and where the word "Government is used, substitute the word "Purchaser".

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1. "Employment of the Handicapped" (41-CFR-1-12.904)

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6. "Price Reduction for Defective Cost or Pricing Data" (41-CFR-1-3.814-1)
7. "Notice of Labor Disputes"

EATON OPERATING COMPANY, INC.

January 16, 1981

Crown Zellerbach Corporation
One Bush Street
San Francisco, California 94104

Attention: Dr. E. G. Tonn

Re: Shell Oil Company - Crown Zellerbach Corporation
No. 1, Martin Exploration Co. - Crown Zellerbach
No. 2, Section 19 and 20, Township 6 South, R5E,
Livingston Parish, Louisiana

Dear Dr. Tonn:

Eaton Operating Company, Inc. (hereinafter referred to as "EATON"), a Texas corporation, is a party to a written contract with the Department of Energy (hereinafter referred to as "D.O.E.") which calls for EATON to carry out research, field testing and evaluation of well sites in the Louisiana-Texas Gulf Coast area where reservoir and production data can be obtained to assess the energy potential of the Gulf Geopressured-Geothermal Aquifers.

Eaton is seeking well locations which, if they are not presently productive of oil or gas, can be taken over for a short test when the operator has made the decision to plug and abandon such a well.

Crown Zellerbach Corporation (hereinafter referred to as "CROWN") is the owner of two (2) tracts of land located in Sections 19 and 20, respectively, of Township 6 South, Range 5 East, Livingston Parish, Louisiana, upon which there have been drilled two (2) wells in search of hydrocarbons in a liquid or gaseous state, which wells are identified more specifically as the Martin Exploration Company-Crown Zellerbach Corporation No. 2 Well, located in Section 19, and the Shell Oil Company-Crown Zellerbach Corporation No. 1 Well located in Section 20, (hereinafter referred to as "Subject Wells"), which wells, and the lands owned by Crown in the vicinity thereof committed to this agreement, are outlined in red on the plat attached hereto and made part hereof as Exhibit A.

Under the proposed operation plan outlined herein, EATON has acquired from MARTIN EXPLORATION COMPANY (hereinafter referred to as "MARTIN") all of the right, title and interest in and to the salvage rights to the Subject Wells, which are reserved to Martin under Paragraph 8 of that certain Mineral Lease

PHONE 713-627-9764
TWX 910-881-1793
EDEC-HEC-HOU

3100 EDLOE, SUITE 205
HOUSTON, TEXAS 77027

U.S. DEPARTMENT OF ENERGY
CONTRACT NO.
DE-AC08-80ET27081

dated May 29, 1975, executed by Crown, as lessor, in favor of Shell, as lessee, as supplemented by agreement dated July 5, 1977 (hereinafter referred to as "Shell Lease") pursuant to which the Subject Wells were drilled. Eaton will use the Subject Wells, and the drill sites outlined in red on Exhibit "A", to perform temperature, pressure and gas content measurements at various flow rates, evaluate same and make written reports thereon to the United States Department of Energy.

CROWN will provide EATON with:

(i) the necessary access to the drill sites shown on Exhibit "A", and

(ii) a right-of-way for an "8" inch or less pipeline which will connect the Subject Wells during the term of this agreement.

This letter, when accepted and agreed to by CROWN, which shall be the effective date hereof, shall, subject to the conditions stipulated herein, evidence the agreement between EATON and CROWN, as follows:

(1) EATON, at its sole cost, risk and expense, will make its best effort to enter the Subject Wells and complete said wells for geothermal testing. Should this reentry prove unfeasible, then EATON shall restore and clean up the drill sites shown on Exhibit "A" and this agreement shall terminate as to both parties.

(2) Should EATON succeed in reentering the Subject Wells so as to commence further operations as stated above, then, at that point, EATON shall pay to CROWN, for the right to perform such testing, measurements and evaluation of geopressured-geothermal reservoirs, the sum of Thirty Thousand Dollars ($30,000.00) cash.

(3) The right granted to EATON for such consideration shall include the right, at EATON's election, to utilize the Shell Oil Company-Crown Zellerbach No. 1 Well as a saltwater disposal well and the right to lay a temporary water line between the Subject Wells.

(4) In connection with all its operations, including but not limited to reentry of the wells, and creating a saltwater disposal well, EATON shall:

(a) Provide insurance coverage, naming CROWN as an insured party, on all of its operations hereunder with limits of not less than Eighty Million Dollars ($80,000,000.00) for liability and Twenty-Five Million Dollars ($25,000,000.00) for cost of well control; and

(b) Obtain all federal, state and local governmental permits required for its operations and perform all such operations in accordance with reasonable industry standards and in compliance with applicable governmental and regulatory agency requirements.

(c) Should EATON find it unfeasible to reenter the Subject Wells for the purposes hereof, EATON at its sole expense, shall plug and abandon said wells in compliance with applicable governmental regulations and shall restore and clean up the drill sites shown on Exhibit "A".

(5) As part of the consideration to CROWN hereunder, in the event EATON succeeds in entering the Subject Wells, which entry shall be accomplished no later than one hundred and eighty (180) days from the effective date hereof, then upon EATON notifying CROWN in writing that it has completed or ceased its testing, measuring and evaluation operations, which shall be finalized within one hundred eighty (180) days from the date of actual entry by EATON, CROWN shall have one hundred and twenty (120) days from the date of notice within which to elect, by written notice to EATON, to receive from EATON, without necessity of any further consideration, the full ownership of the Subject Wells, with all casing in either or both of said wells. EATON shall not plug and abandon either of the Subject Wells during said period unless CROWN has notified EATON in writing that it does not elect to receive said wells, or either of them. Upon CROWN notifying EATON that it elects not to receive either or both said wells, upon expiration of said period of one hundred twenty (120) days without CROWN having given notice of election to receive either or both of said wells, then EATON shall, at its sole risk and expense, plug and abandon, in accordance with the rules and regulations of the Louisiana Department of Conservation, and other applicable governmental regulations, either or both of said wells which CROWN shall have elected not to receive, either by notice to EATON or by non-action within said period. If CROWN elects to receive either or both said wells, EATON shall convey what interest it (EATON) has thereto to CROWN with the casing therein. Upon such conveyance as to the well or wells CROWN shall elect to receive, and/or the plugging and abandoning of either or both said wells which CROWN does not elect to receive, EATON shall vacate the drill sites shown on Exhibit "A" and shall have no further liability hereunder except for previously and accrued obligations.

(6) Also as part of the consideration to CROWN hereunder, EATON will furnish to CROWN, directed to Dr. E. G. Tonn, Crown Zellerbach Corporation, 1 Bush Street, San Francisco, California 96104, all test well data, analyses, information and evaluation obtained from EATON's operations, including pressures, temperatures, flow rates, recervoir limit test information and analyses,

and chemical and physical analyses of both the brine and the gases, and consisting in general of the same information that will be provided by EATON to D.O.E. under Contract DE-AC08-80ET27081.

(7) CROWN's agreement hereto is made expressly subject to the following conditions:

(a) All hydrocarbons recovered and sold by EATON as the result of the operations to be conducted by EATON hereunder shall be the property of CROWN.

(b) All rights of EATON hereunder shall terminate within one hundred and eighty (180) days of the date on which EATON succeeds in entering the Subject Wells for the purpose hereof, except that any previously accrued obligations of EATON shall survive said termination.

(c) That oil, gas and mineral lease dated January 5, 1981, executed by Crown Zellerbach Corporation as lessor, in favor of Pennzoil Producing Co., as lessee, which lease specifically excludes the right to conduct geothermal operations.

(8) The rights granted EATON hereunder, shall not be assigned, surrendered or otherwise transferred without the prior written consent of Crown Zellerbach.

(9) Attached hereto are the following documents entitled "Terms and Conditions of Purchase Order" and "Additional Terms and Conditions of Purchase Order," which are marked Exhibit I and Exhibit II; which, are incorporated by reference herein as if fully set out in total context and made a part hereof.

(10) EATON further expressly states herein that any and all portions of this agreement shall be subject to the approval of the United States Department of Energy; and, should said agency disapprove any of this agreement in whole or in part, then said agreement shall be null and void.

(11) Notices hereunder shall be in writing and shall be deemed to have been given if sent by telegram, certified or registered mail, or delivered by hand, addressed to the respective parties, as follows:

If to EATON:

Eaton Operating Company, Inc.
3100 Edloe, Suite 205
Houston, Texas 77027

Attention: Mr. B. A. Eaton
Telephone: 713/627-9764

If to Crown:

Crown Zellerbach Corporation
One Bush Street
San Francisco, California 94104

Attention: Dr. E. G. Tonn
Telephone: 415/951-5240

This letter is executed on behalf of EATON in triplicate copies. If the provisions hereof conform to your understanding of the agreement between us, please execute and return two (2) copies to us.

Yours very truly,

EATON OPERATING COMPANY, INC.

B. A. Eaton, President

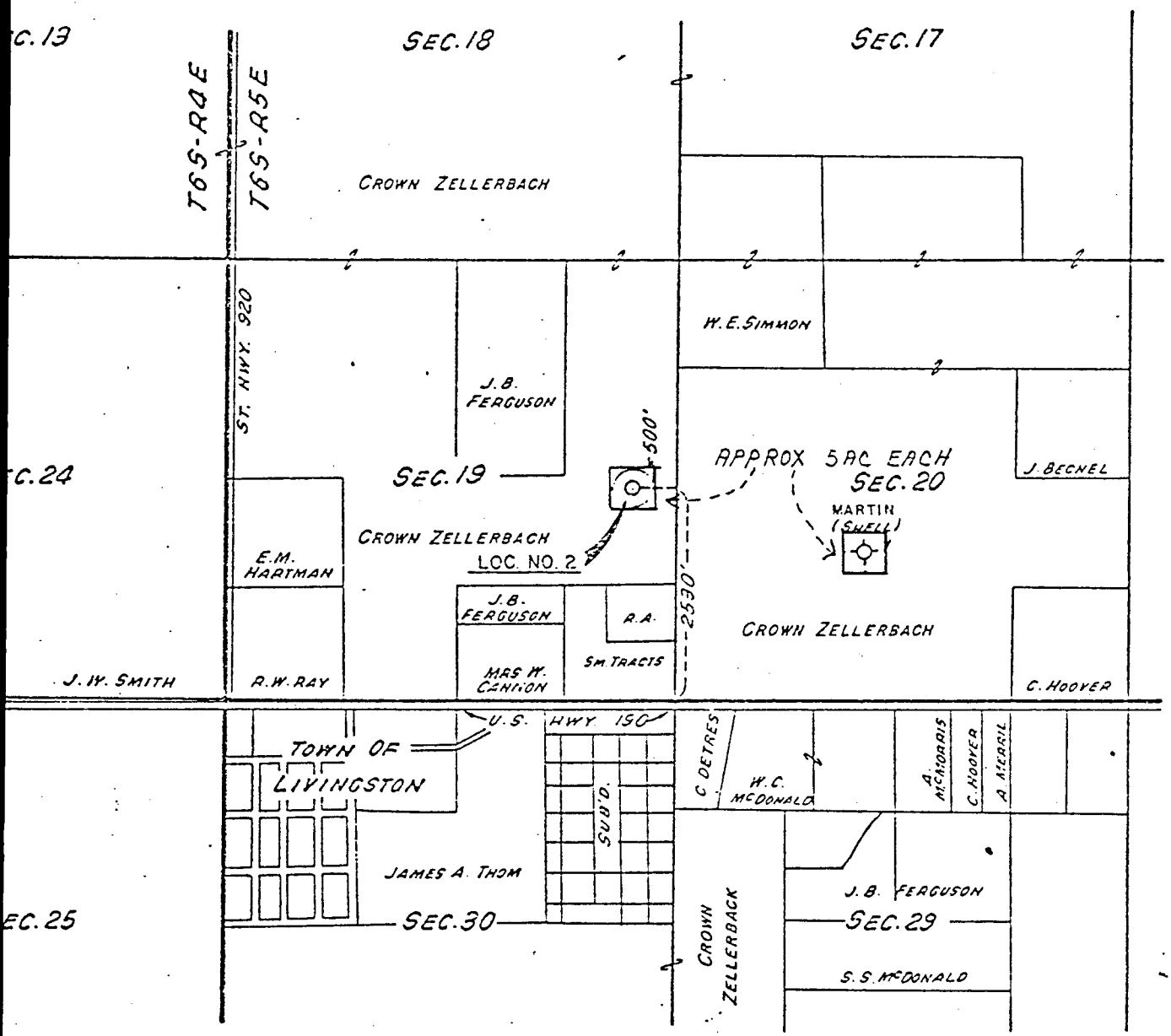
ACCEPTED AND AGREED TO this

_____day of _____, 1981.

CROWN ZELLERBACH CORPORATION

By _____
M. S. Denman, Executive Vice President

EXHIBIT "A"



STATE OF LOUISIANA
AUBREY G. BURKE
REG. NO. 184
REGISTERED
LAND SURVEYOR

MARTIN EXPLORATION CO.

CROWN ZELLERBACH
LOC. NO. 2

SEC. 19 T6S-R5E
LIVINGSTON PH., LA.
SCALE 1"=2000' MARCH 1980

AUBREY G. BURKE, SURVEYOR
REG. NO. 184 N. O., LA. 70112

EXHIBIT I

TERMS AND CONDITIONS OF PURCHASE ORDER

1. INSPECTION AND ACCEPTANCE — Inspection and acceptance will be at destination, unless otherwise provided. Until delivery and acceptance, and after any rejections, risk of loss will be on the Contractor unless loss results from negligence of the Purchaser.

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3. DISCOUNTS —Discount time will be computed from date of delivery at place of acceptance or from receipt of correct invoice at the office specified by the Purchaser, whichever is later. Payment is made, for discount purposes, when check is mailed.

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5. CONVICT LABOR — In connection with the performance of work under this contract, the Supplier agrees not to employ any person undergoing sentence of imprisonment except as provided by (41 CFR-1-11.204).

6. OFFICIALS NOT TO BENEFIT — No member of, or delegate to, Congress, or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

7. COVENANT AGAINST CONTINGENT FEES — The Supplier warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon any agreement or understanding for a commission, percentage, brokerage, or contingent fees, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Supplier for the purpose of securing business. For breach or violation of this warranty the Purchaser shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration, or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

8. FEDERAL, STATE AND LOCAL TAXES — Except as may be otherwise provided in this contract, the contract price includes all applicable Federal, State, and local taxes and duties in effect on the date of this contract but does not include any taxes from which the Purchaser, the Supplier on this transaction is exempt.

9. Goods must be shipped as per instructions; otherwise any extra handling charge will be billed back to seller.

Approved By: _____

Title: _____

Date: _____

EXHIBIT II

ADDITIONAL
TERMS AND CONDITIONS OF PURCHASE ORDER

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1. "Notice and Assistance Regarding Patent and Copyright Infringement" (41-CFR-9-9.104)
2. "Utilization of Small Business Concerns" (41-CFR-1-1.710-3)
3. "Utilization of Labor Surplus Area Concerns" (41-CFR-1-1.805-3)
4. "Utilization of Minority Business Enterprises" (41-CFR-1-1.1310.2)
5. "Equal Opportunity" (41-CFR-1-12.803.12)
6. "Disabled Veterans and Veterans of the Vietnam Era"
7. "Termination for Convenience of the Government"(41-CFR-1-8.705-1)
8. "Pricing Adjustment"(41-CFR-1-7.102-20)
9. "Walsh Healy Public Contracts Act"(41-CFR-1-12.605)

Applies to Subcontracts or purchase orders which provide for the performance of Service

1. "Contract Work Hours and Safety Standard Act - Overtime Compensation" (41-CFR-1-12.303)
2. "Service Contract Act of 1965 - As Amended" (41-CFR-1-12.904)

Applies to Subcontracts or purchase orders which exceed $100,000

1. "Cost Accounting Standard" (41-CFR-1-3.1204-1)
2. "Authorization and Consent" (41-CFR-9-9.102-1)
3. "Examination of Records" (41-CFR-1-7.103-3)
4. "Audit and Record" (41-CFR-1-3.814.2)
5. "Subcontractor Cost and Pricing Data" (41-CFR-1-3.814-3)
6. "Price Reduction for Defective Cost or Pricing Data" (41-CFR-1-3.814-1)
7. "Notice of Labor Disputes"

4.0 GEOPRESSURED-GEOTHERMAL PROSPECT

4.1 Location

The Martin Exploration Company Crown Zellerbach #2 is located 25-1/2 miles east of Baton Rouge between Satsuma and Holden and 2530' north of Highway 190 on the outskirts of Doyle (Figure 4-1). The specific well location is 2530' from the south line and 500' from the east line of Section 19, Township 6S and Range 5E in Livingston Parish, Louisiana (Figure 4-2).

4.2 Geology

The prospective geopressured reservoirs occur in the Tuscaloosa Trend of Upper Cretaceous Age. The Tuscaloosa is composed of alternating sands and shales, extending across Louisiana from St. Tammany Parish on the east to Beauregard Parish on the west. It varies from 2 to 12 miles in width. A net sand isopach map of a portion of the trend, which has been published by Zaki Bassiouni of the LSU Petroleum Engineering Department is shown in Figure 4-3.

The Satsuma area in which the proposed test well was drilled is situated down dip to the Edwards Reef Complex where the Tuscaloosa sands have a maximum development. A detailed seismic study was conducted in the Satsuma area. The structure contour map is shown in Figure 4-4, and the two cross sections in Figures 4-5 and 4-6 are based primarily on the data from this study. As indicated by these figures, the test well is located on an anticlinal fold between two down-to-the-coast growth faults. The throw is approximately 900 feet and 450 feet for the northernmost and southernmost faults, respectively.

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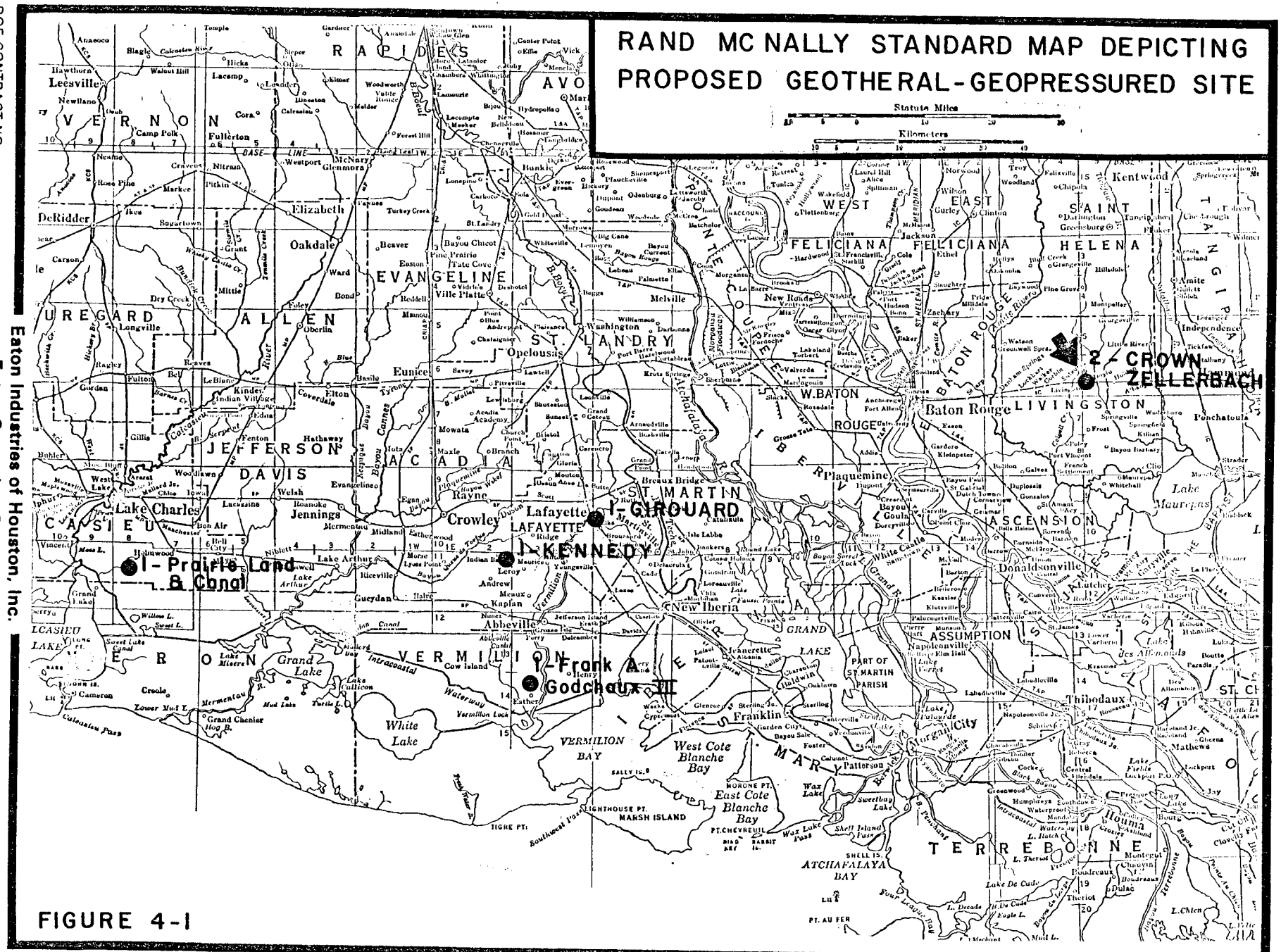
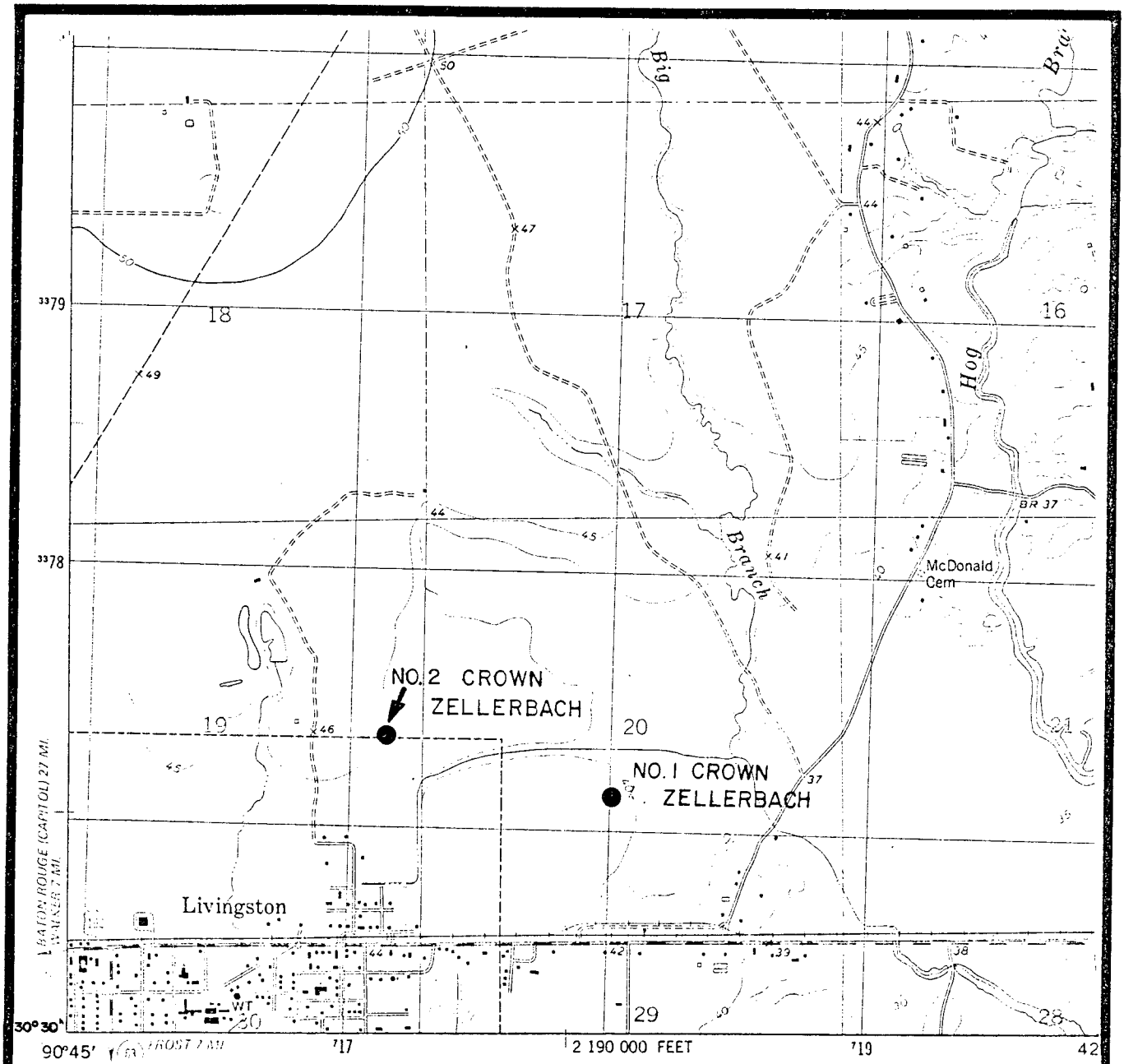


FIGURE 4-1



Mapped, edited, and published by the Geological Survey

HOLDEN, LA.

SW/4 AMITE 15' QUADRANGLE

N3030—W9037.5/7.5

1974

AMS 7845 II SW—SERIES V895

ROAD CLASSIFICATION

Primary highway, hard surface

Secondary highway, hard surface

Light-duty road, hard or improved surface

Unimproved road

Interstate Route U. S. Route State Route

SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

TOPOGRAPHIC MAP
FIGURE 4-2

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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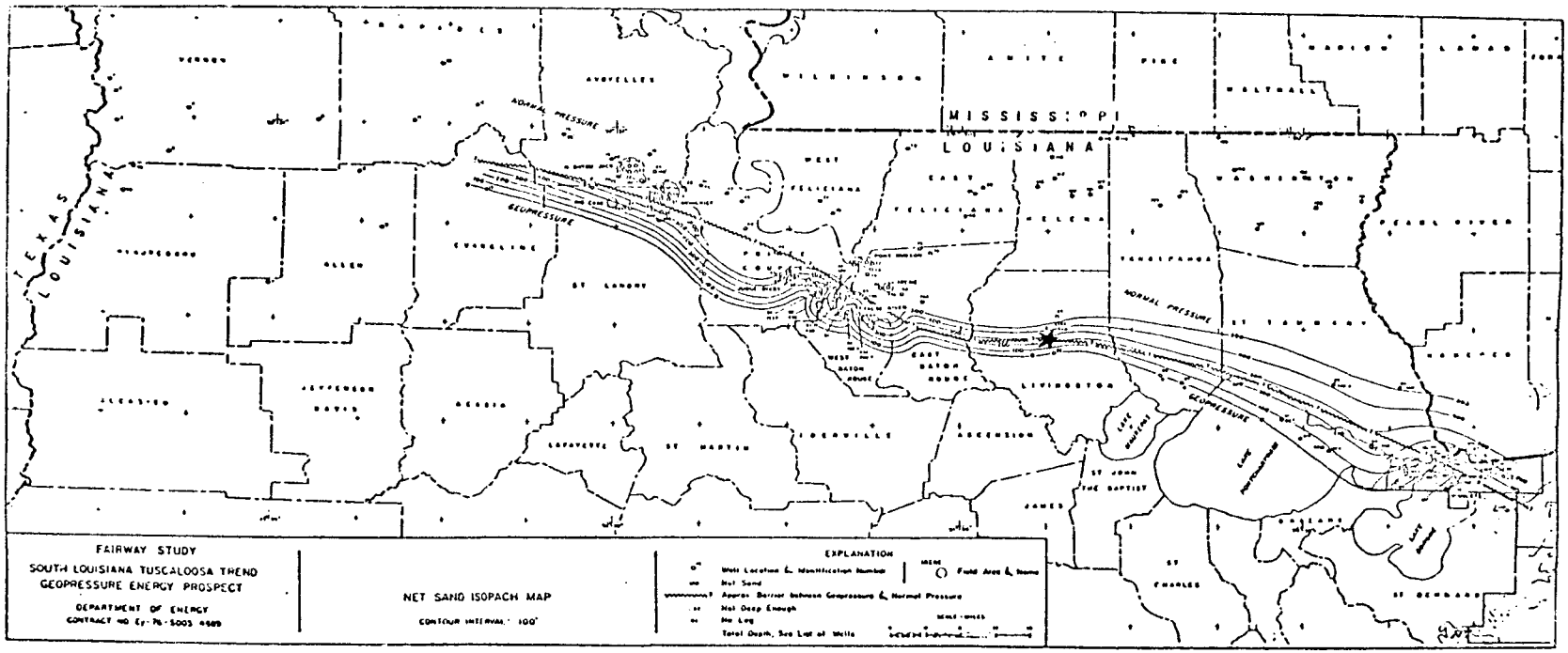

AFTER BASSIOUNI, 1979

NET SAND ISOPACH MAP GEOPRESSURED TUSCALOOSA TREND

FIGURE 4-3

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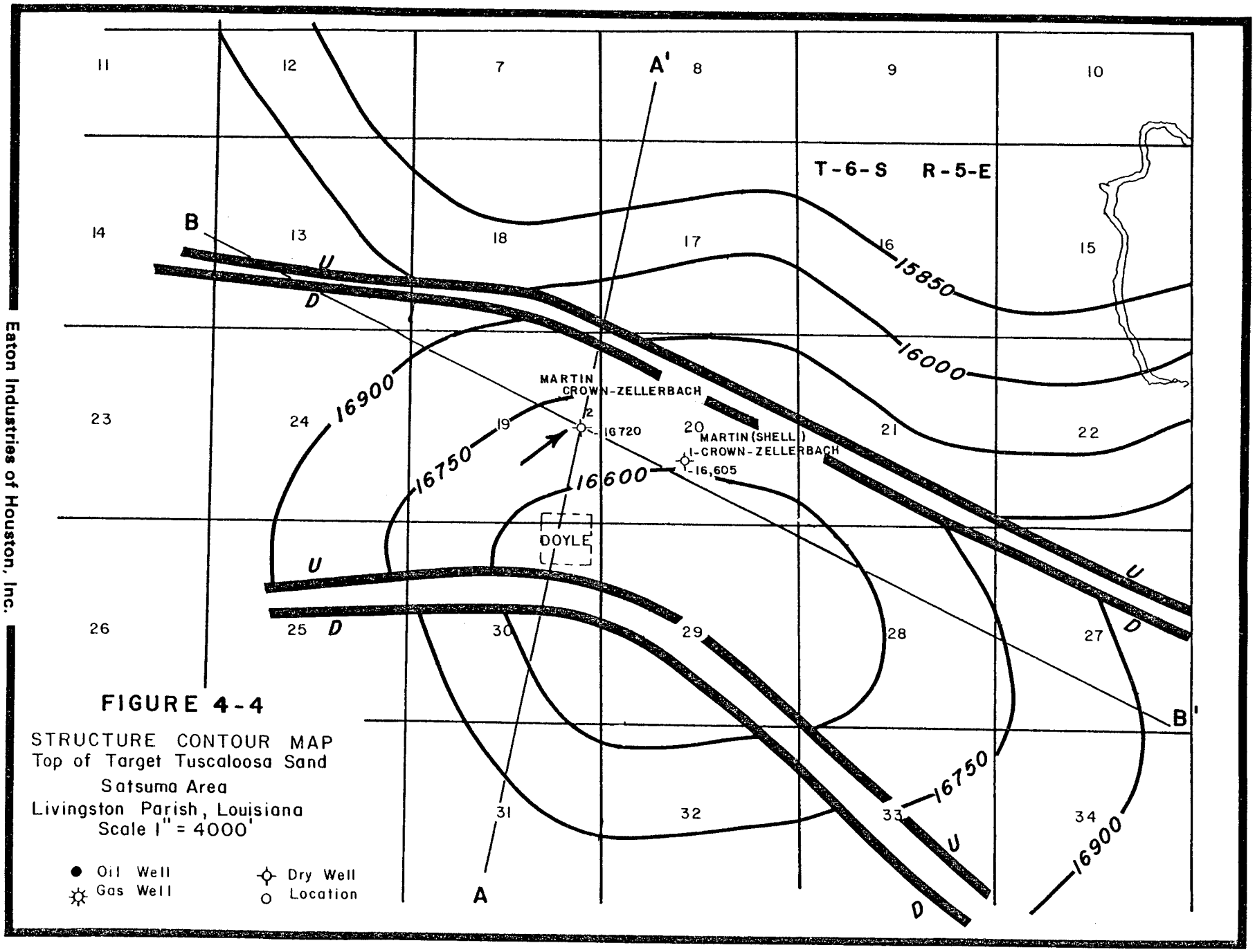

FIGURE 4-4

STRUCTURE CONTOUR MAP
Top of Target Tuscaloosa Sand
Satsuma Area
Livingston Parish, Louisiana
Scale 1" = 4000'

● Oil Well
☼ Gas Well
☼ Dry Well
○ Location

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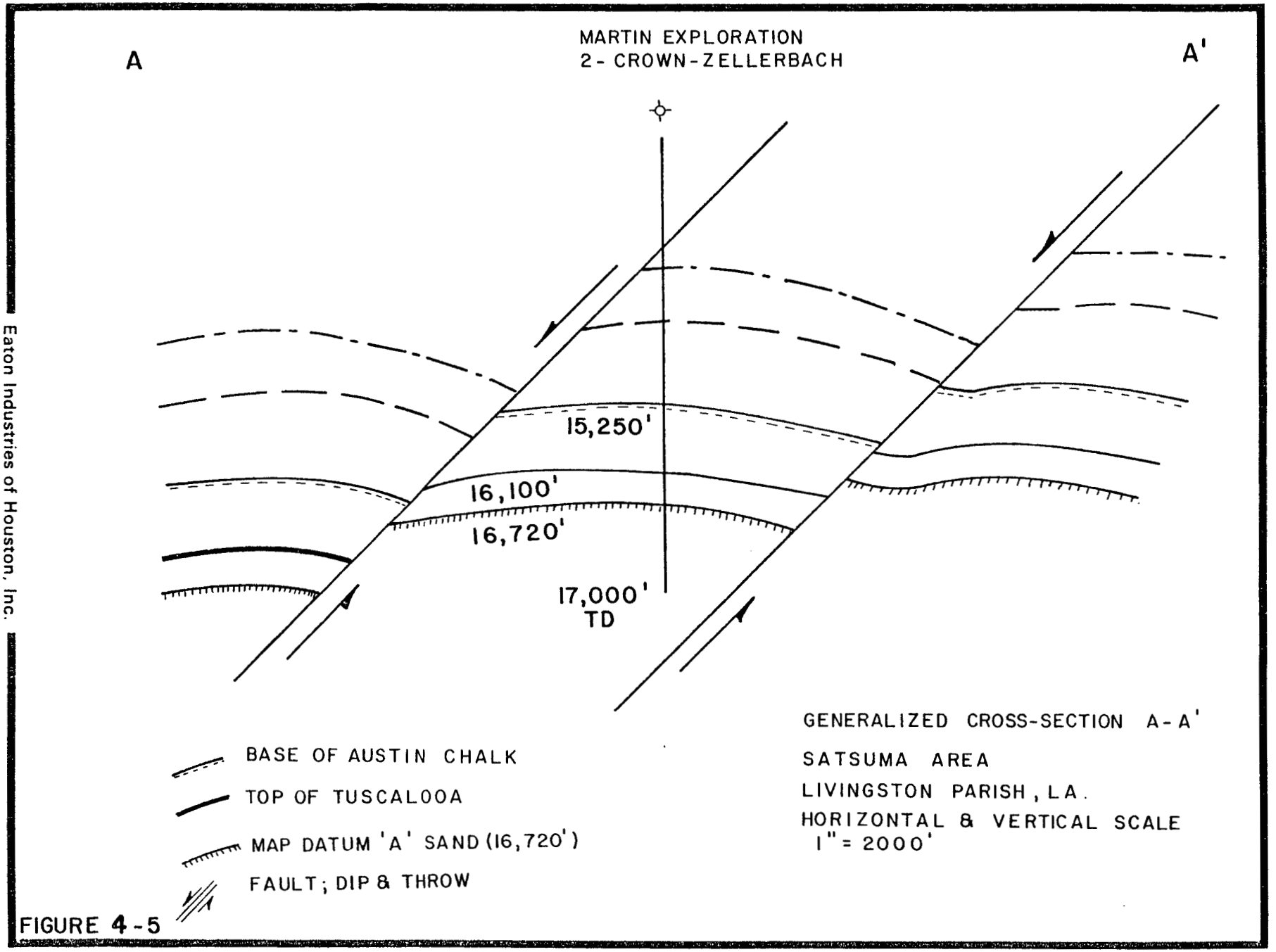

FIGURE 4-5

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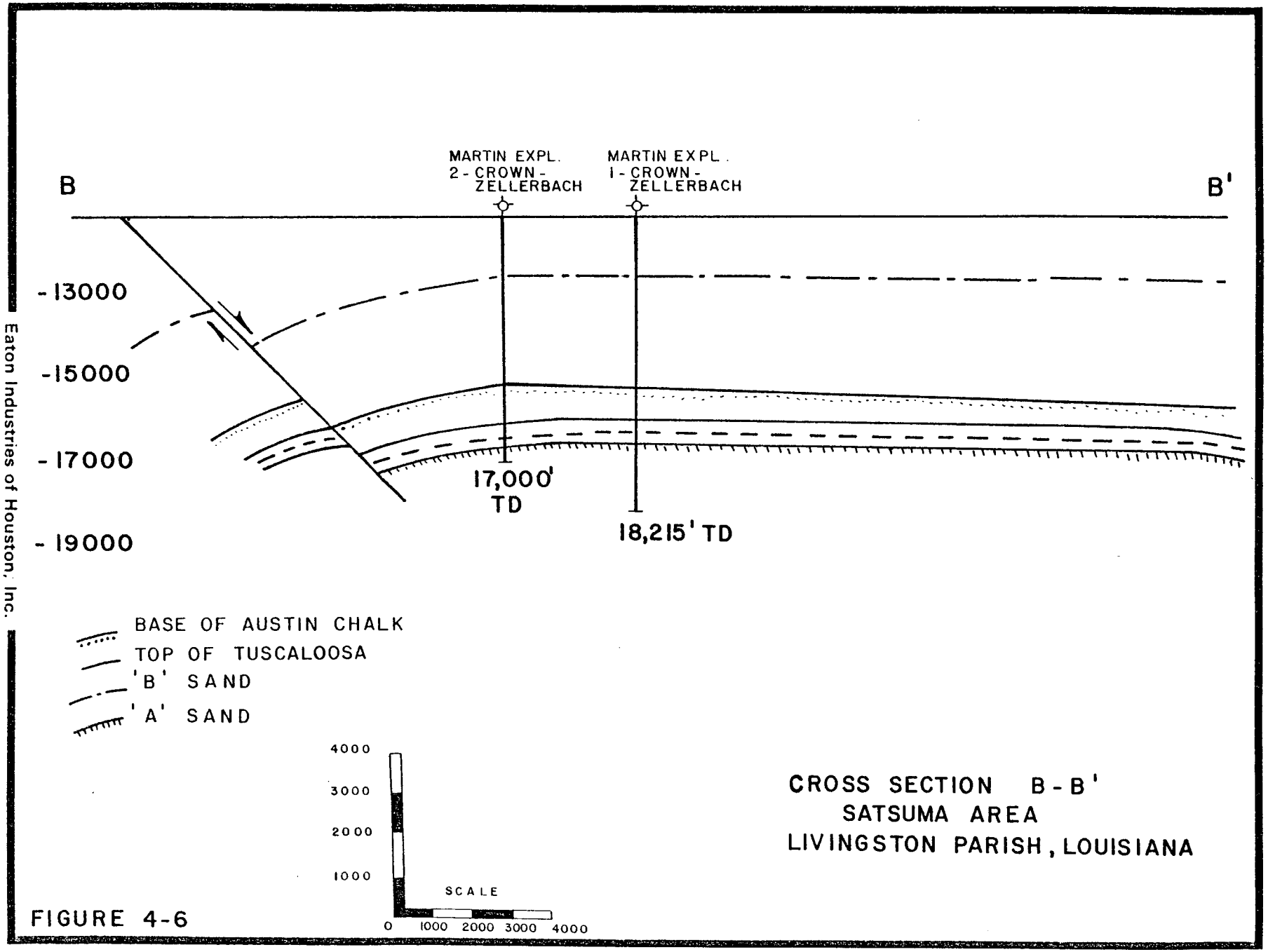


FIGURE 4-6

CROSS SECTION B-B'
SATSUMA AREA
LIVINGSTON PARISH, LOUISIANA

The two target Tuscaloosa sands occur at a depth of 16,718' to 16,754' (Sand "A") and 16,462' to 16,490' (Sand "B"). The maximum individual sand thickness ranges up to 36 feet (Figure 4-7).

Personal communication with people who work the Tuscaloosa Trend indicate good log correlation of the Tuscaloosa between wells. Therefore, one would assume good reservoir continuity. The reservoir encompasses at least 4,800 acres.

4.3 Reservoir Characteristics

The predicted reservoir characteristics of the two target Tuscaloosa sands based on analysis of the Martin Exploration Company Crown Zellerbach #2 logs are as follows:

I. Sand "A" - Primary Target (16,718' - 16,754')

Sand Thickness:

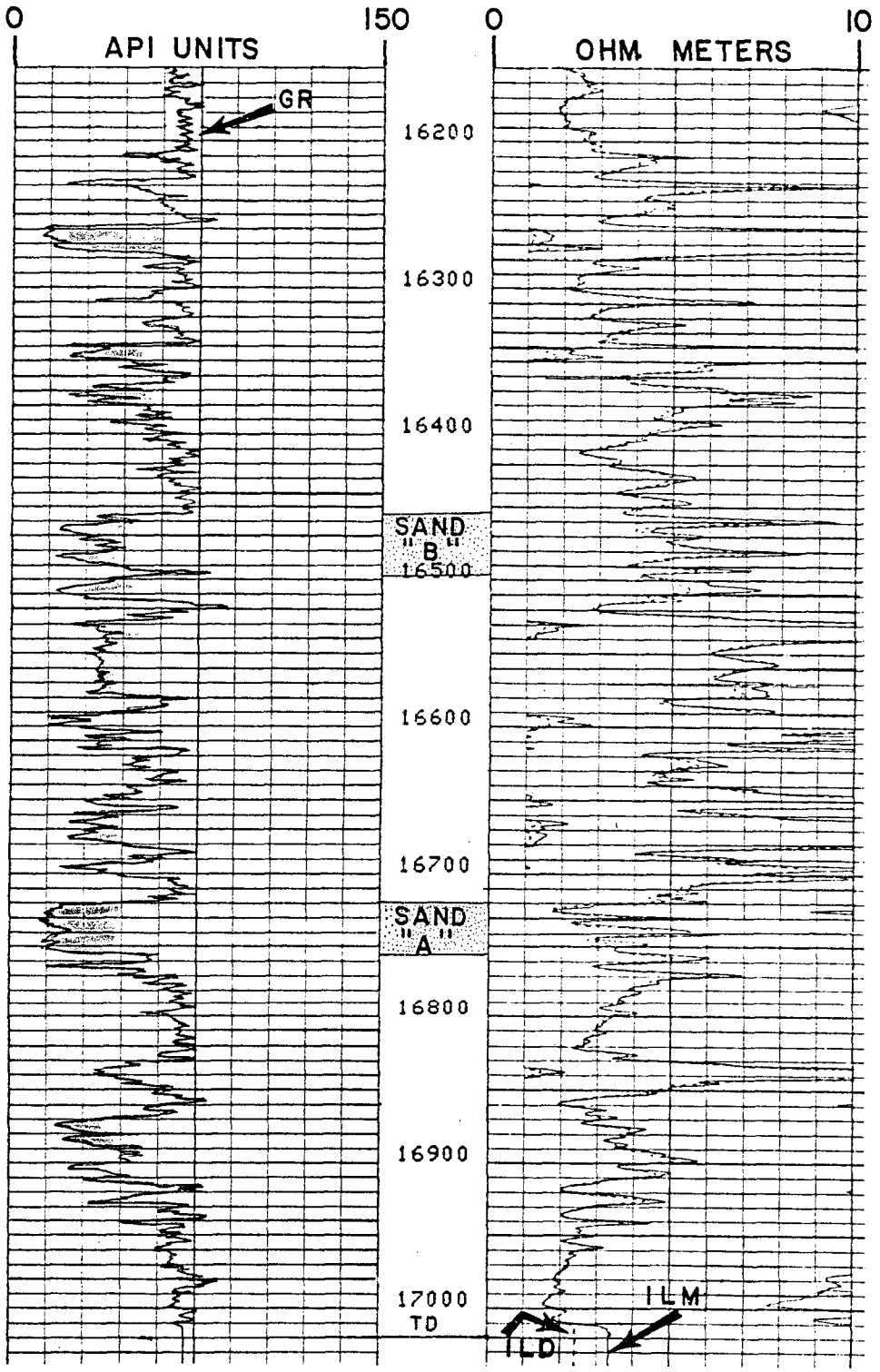
Gross sand thickness of the target interval, 16,718' to 16,754' (kb), is 36 feet (Figure 4-8).

Net Sand Thickness:

A total net sand thickness is 35 feet based upon the analysis of the Density/Neutron log. A porosity cutoff of 9% was applied in aiding the determination of the net sand.

Porosity:

The average porosity of the net sand interval is 17% based upon analysis of the Density/Neutron log. The porosities in this



DUAL INDUCTION/ BOREHOLE COMPENSATED SONIC LOG

CROWN ZELLERBACH NO. 2 - UPPER TUSCALOOSA

FIGURE 4-7

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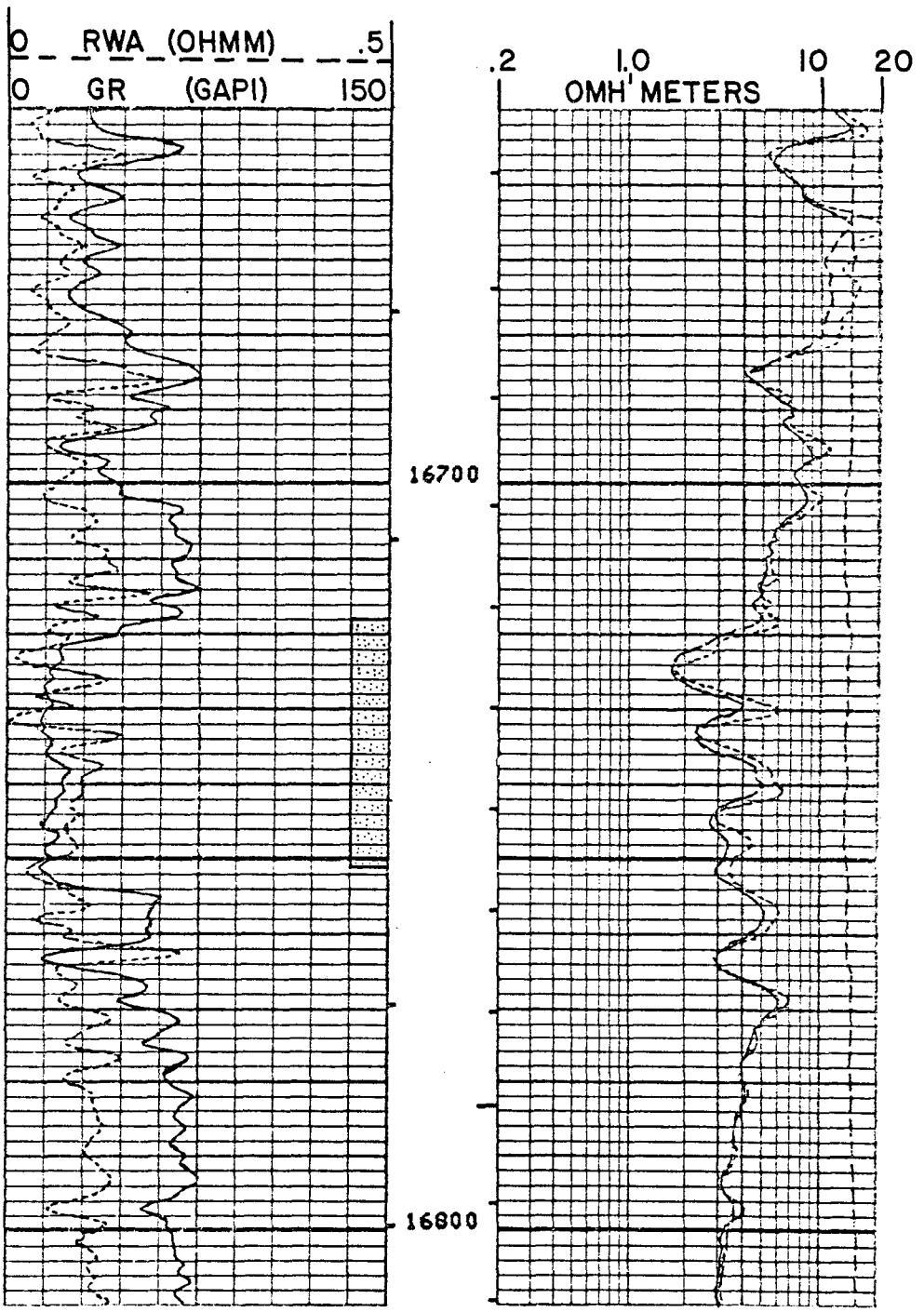

DUAL INDUCTION BOREHOLE COMPENSATED SONIC LOG
SAND "A", CROWN ZELLERBACH NO. 2

FIGURE 4-8

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DOE CONTRACT NO.
DE-AC08-80ET-27081

interval ranged from 9% to 27% (Figure 4-9).

After much discussion with a representative from Schlumberger, it was decided that DRHO on the Compensated Neutron-Formation Density Log is too high for the mud weight used. Therefore, the porosity appears to be 3-5% lower on the log than it actually is. In attempting to correct for this error, a 4% correction factor was added to the apparent porosities.

Pressure:

Using the mud weight of 13.8#/gallon mud, the hydrostatic head is estimated to be 12,023 psi at 16,754 feet.

Temperature:

The temperature is estimated to be 297°F at 16,754' based on a BHT of 298°F at 17,000' measured after circulation had been stopped for 11-1/2 hours.

Salinity:

The salinity was derived using the modified Humble equation:

H. H. Dunlap, Center For Energy Studies

First Progress Report, March 1980.

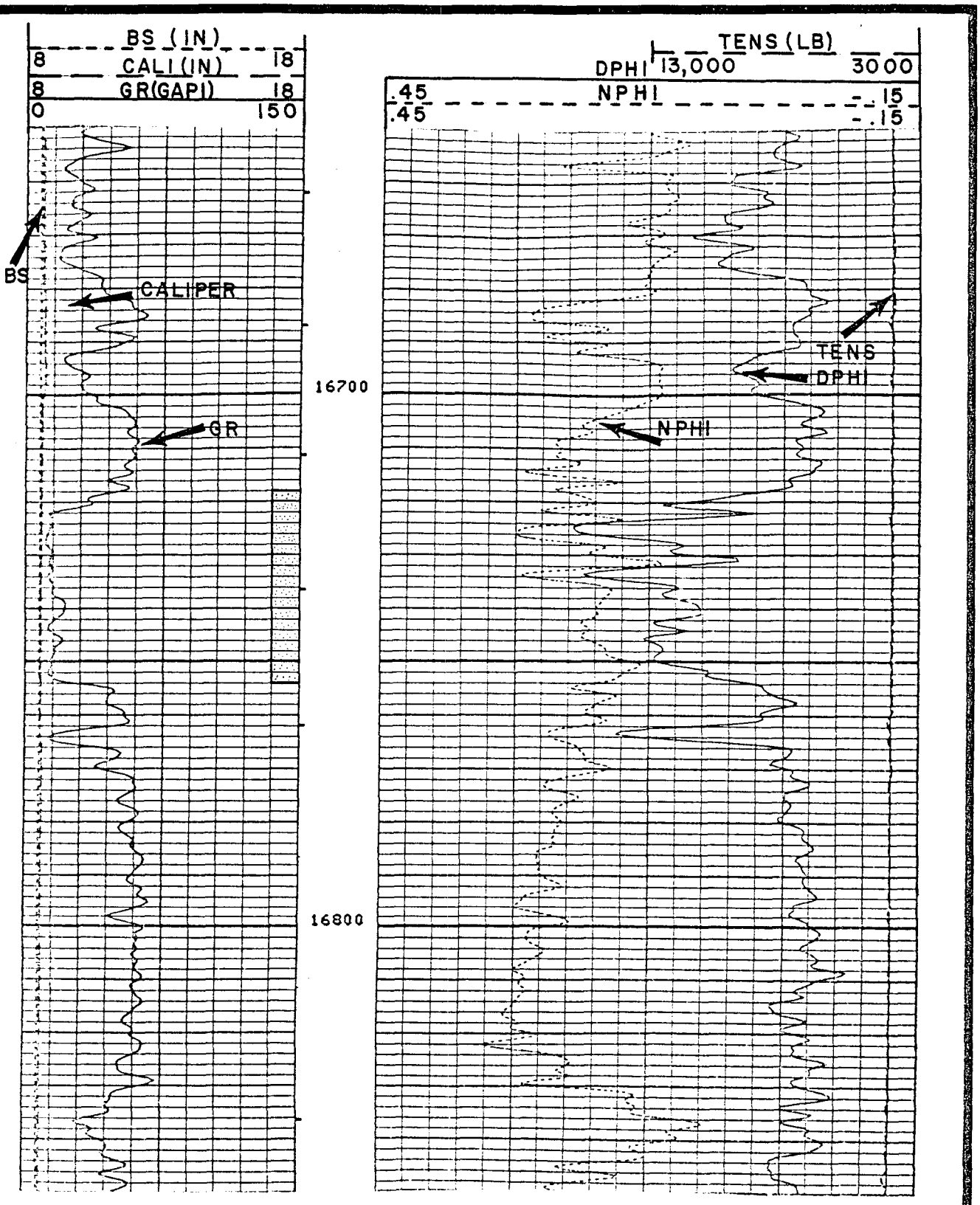
$R_{wa} = \phi^2 R_t / .81$

$R_t = 3$

$\phi = 17.085\%$

$R_{wa} = .1081$

$S = 16{,}000$ ppm



COMPENSATED NEUTRON-FORMATION DENSITY LOG
SAND "A", CROWN ZELLERBACH NO. 2

FIGURE 4-9

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Gas Content:

Assuming saturation and a pressure of 12,023 psi, the gas content is estimated to be 51 SCF/Bbl. This estimate was obtained by applying a "field correction factor" of .88 to the Blount, et al value of 58 SCF/Bbl.

II. Sand "B" - Alternate Target (16,462' - 16,490')

Sand Thickness:

Gross sand thickness of this target interval, 16,462' to 16,490' (kb), is 28 feet (Figure 4-10).

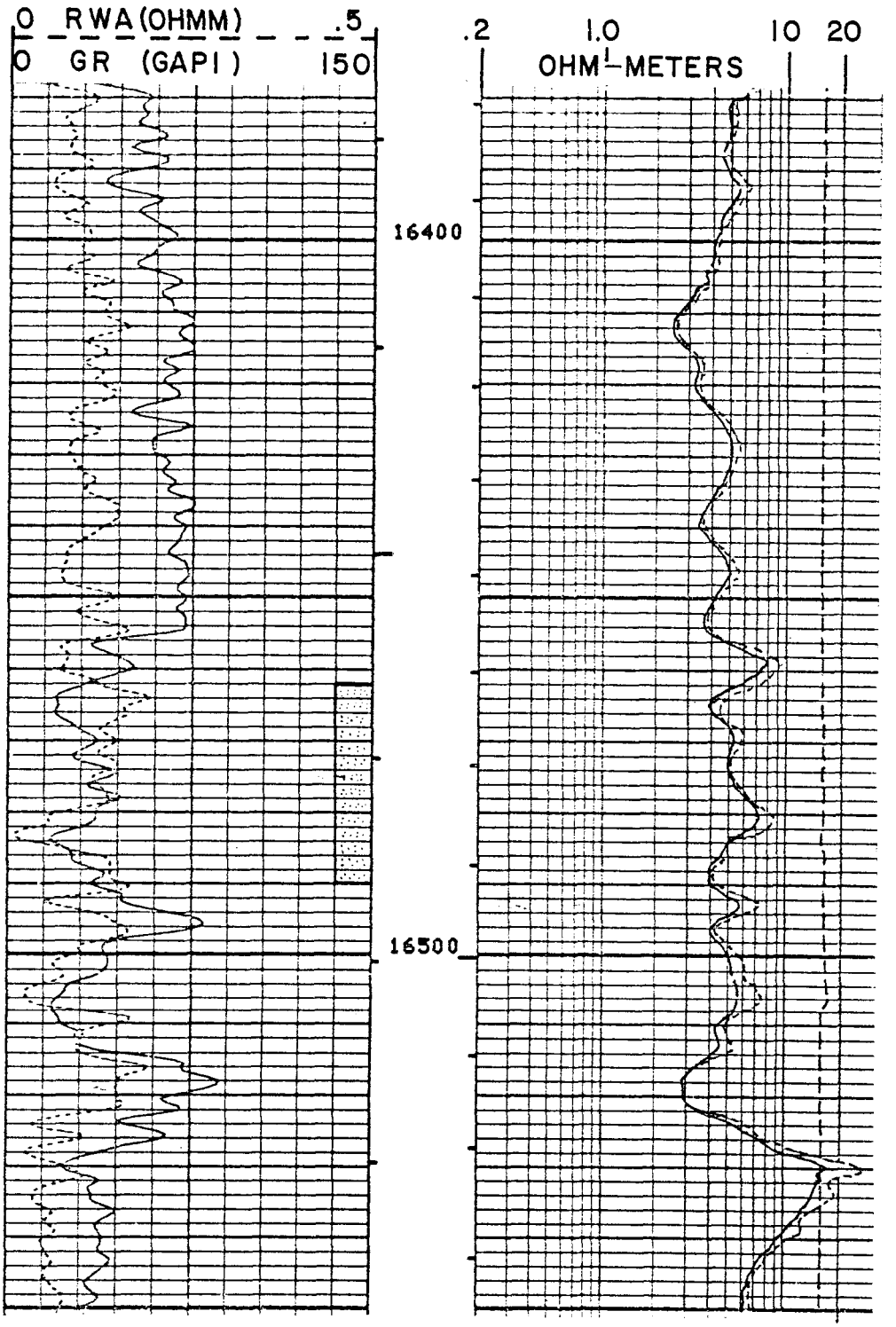
Net Sand Thickness:

A total net sand thickness is 23 feet based upon the analysis of the Density/Neutron log. A porosity cutoff of 9% was applied in aiding the determination of the net sand.

Porosity:

The average porosity of the net sand interval is 13.74% based upon analysis of the Density/Neutron log. The porosities in this sand interval ranged from 9% to 20% (Figure 4-11).

After much discussion with a representative from Schlumberger, it was decided that DRHO on the Compensated Neutron-Formation Density log is too high for the mud weight used. Therefore, the porosity appears to be 3 - 5% lower on the log than it actually is. In attempting to correct for this error, a 4% correction factor was added to the apparent porosities.



DUAL INDUCTION BOREHOLE COMPENSATED SONIC LOG
SAND "B", CROWN ZELLERBACH NO. 2

FIGURE 4-10

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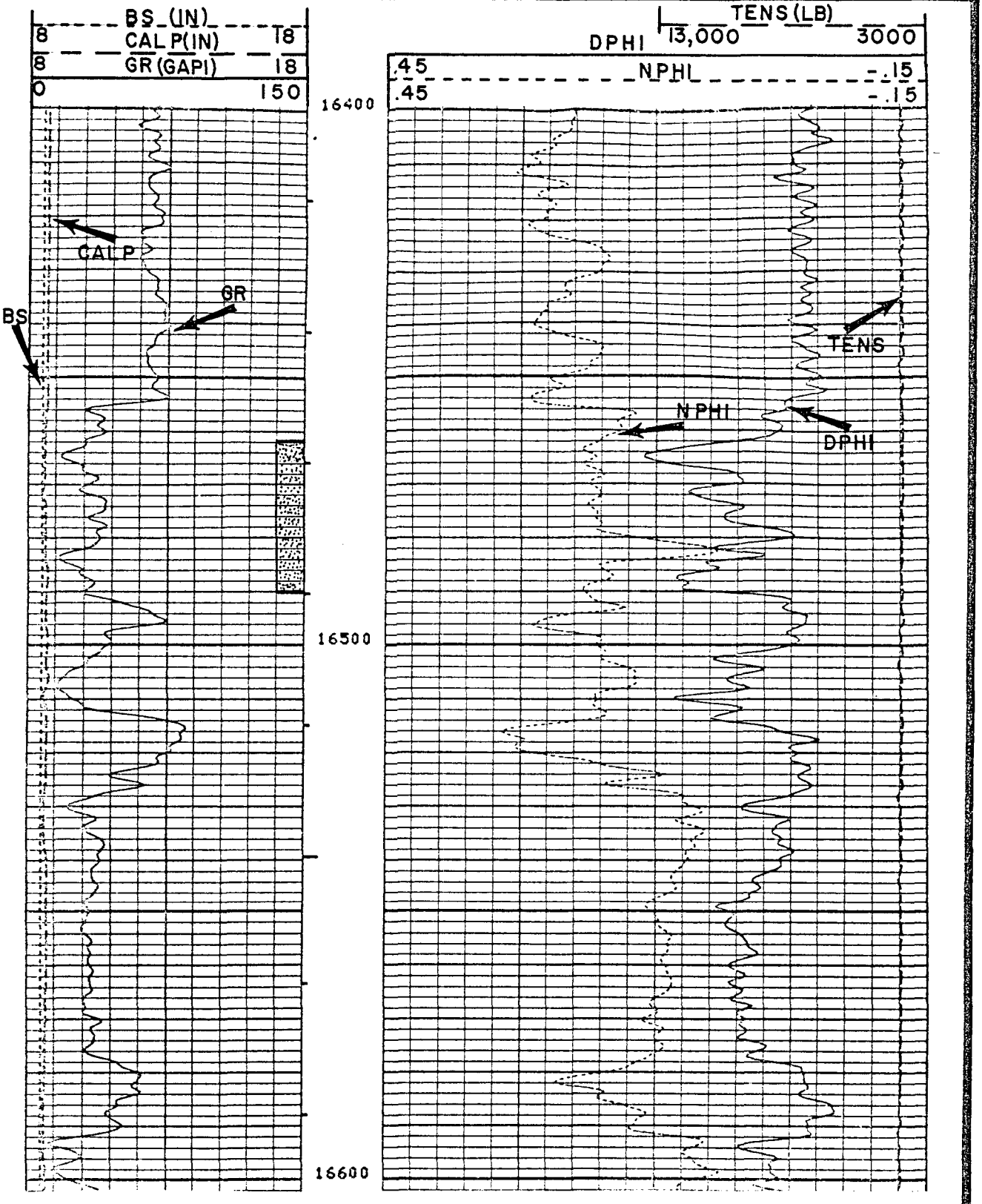

COMPENSATED NEUTRON-FORMATION DENSITY LOG
SAND "B", CROWN ZELLERBACH NO. 2

FIGURE 4-11

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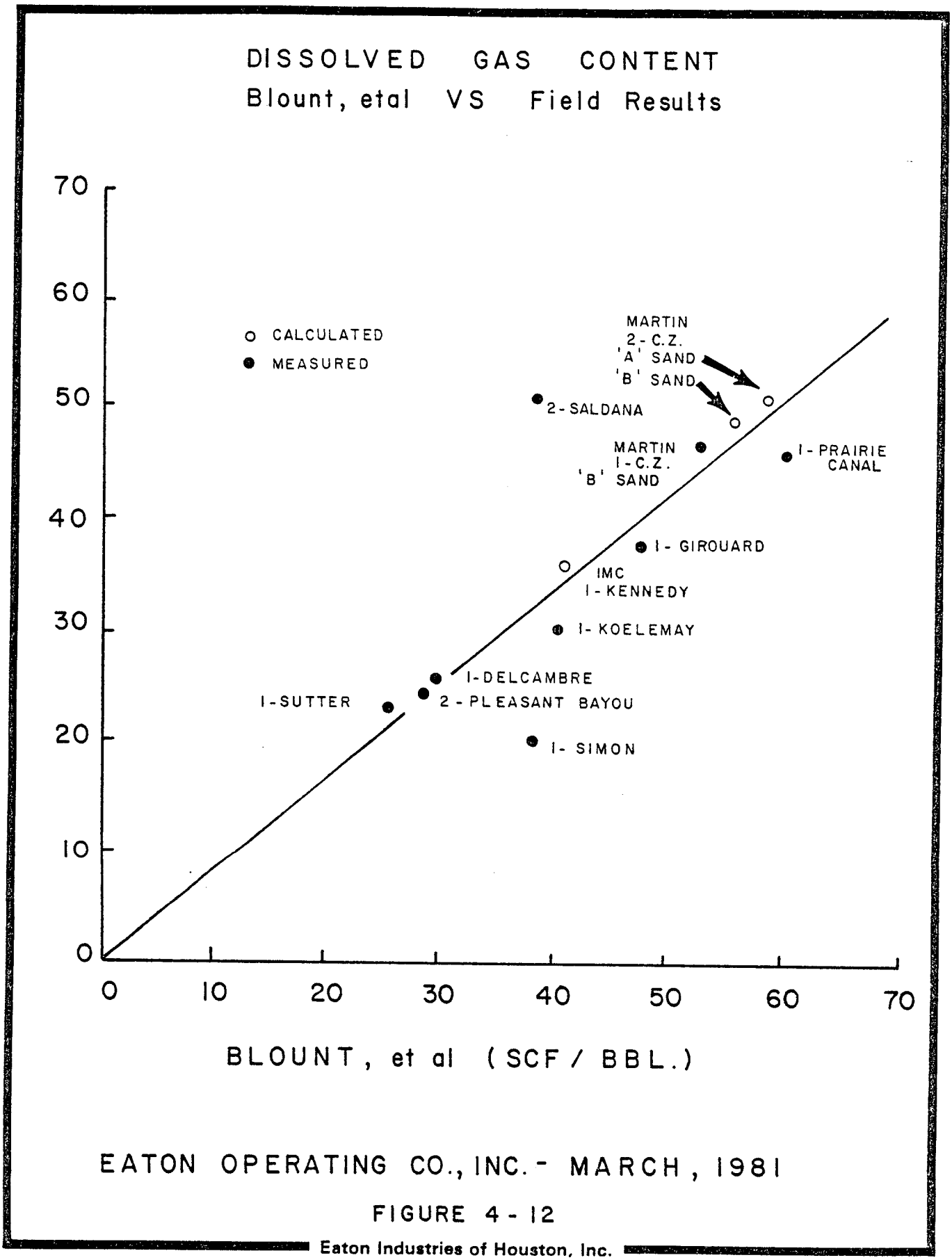

FIGURE 4 - 12

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DOE CONTRACT NO.
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Pressure:

Using the mud weight of 13.8#/gallon mud, the hydrostatic head is estimated to be 11,833 psi at 16,490 feet.

Temperature:

The temperature at 16,490' is estimated to be 293°F based on a BHT of 298°F at 17,000' measured after circulation had been stopped for 11-1/2 hours.

Salinity:

The salinity was derived using the modified Humble equation:

H. H. Dunlap, Center For Energy Studies

First Progress Report, March 1980.

$R_{wa} = \phi^2 R_t / .81$

$R_t = 5$

$\phi = 13.74\%$

$R_{wa} = .1165$

$S = 16{,}000$ ppm

Gas Content:

Assuming saturation and a pressure of 11,833 psi, the gas content is estimated to be 49 SCF/Bbl. This estimate was obtained by applying a "field correction factor" of .88 to the Blount, et al value of 56 SCF/Bbl.

4.4 Resource and Deliverability Projections

The amount of brine and natural gas contained in the target Tuscaloosa sands is estimated by volumetric calculation using the following assumptions:

I. Sand "A" - Primary Target (16,718' - 16,754')

a) The aquifer covers approximately 7.5 square miles.

b) The net sand thickness is 35 feet.

c) The average porosity is 17%.

d) The dissolved gas content is 51 SCF/Bbl.

The volume of in-situ brine in the sand is approximately 212.03 x 10^6, i.e. (0.212 billion) barrels. With the above gas solubility of 51 SCF/bbl, the volume of dissolved gas is 10.813 billion standard cubic feet.

During the test period of 13 days, approximately 20,000 barrels of brine and 3,570,000 SCF of dissolved gas will be produced.

Using the fluid compressibility of 3.8 x 10^{-6}, it is estimated that the static reservoir pressure loss at the end of the test period will be approximately 86.88 pounds per square inch in the sand for the predicted reservoir area of 7.5 square miles.

In order to obtain an idea as to the magnitude of expected flow rates from the subject well, the radial flow equation for incompressible fluids in porous media under steady state conditions was evaluated as follows:

$$q = \frac{7.08\ kh\ (\ p)}{\mu\ B\ \ln\ (r_e/r_w)}$$

where:

a) The aquifer covers approximately 7.5 square miles.

b) The net sand thickness is 23 feet.

c) The average porosity is 13.74%.

d) The dissolved gas content is 49 SCF/Bbl.

The volume of in-situ brine in the sand is approximately 0.11256×10^9, i.e. (.1 billion) barrels. With the above gas solubility of 49 SCF/Bbl, the volume of dissolved gas is 5.515 billion standard cubic feet.

During the test period of 13 days, approximately 70,000 barrels of brine and 3,430,000 SCF of dissolved gas will be produced.

Using the fluid compressibility of 3.8×10^{-6} psi, it is estimated that the static reservoir pressure loss at the end of the test period will be approximately 171.0 pounds per square inch in the sand for the predicted reservoir area of 7.5 square miles.

In order to obtain an idea as to the magnitude of expected flow rates from the subject well, the radial flow equation for incompressible fluids in porous media under steady state conditions was evaluated as follows:

$$q = \frac{7.08\ kh\ (\ p)}{\mu\ B\ \ln\ (r_e\ /r_w)}$$

where:

q = calculated flow rate in bbls/day

k = permeability - darcies

h = net sand thickness - feet

DOE CONTRACT NO
DE-AC08-80ET-27081

q = calculated flow rate in bbls/day

k = permeability - darcies

h = net sand thickness - feet

p = pressure drawdown at sand face - psi

μ = viscosity - centipoise

B = formation volume factor - dimensionless

r_e = outer radius - feet

r_w = well bore radius - feet

The radial flow equation was evaluated with the following parameter values which were based on log data and known geological and engineering data. The following numbers are very conservative.

Assume:

k = 50 md = .05 darcy

h = 35 feet

p = 2340 psi

μ = .30 cp

B = 1.0

r_e = 8,158

r_w = .3 feet

Then:

q = 9,096 bbls/day

II. Sand "B" - Alternate Target (16,462' - 16,490')

p = pressure drawdown at sand face - psi

μ = viscosity - centipoise

B = formation volume factor - dimensionless

r_e = outer radius - feet

r_w = well bore radius - feet

The radial flow equation was evaluated with the following parameter values which were based on log data and known geological and engineering data. The following numbers are very conservative.

Assume:

k = 50 md = .05 darcy

h = 23 feet

p = 2350 psi

μ = .30 cp

B = 1.0

r_e = 8,158

r_w = .3 feet

Then:

q = 5,978 bbls/day

4.5 Reservoir Characteristics of the Disposal Well

The predicted reservoir characteristics of the target sand for the salt water disposal well are based on the analysis of the Martin Exploration Co. (Shell) #1 Crown Zellerbach logs.

Sand Thickness:

Gross and net sand thickness of the target interval (4800' - 4900') is 100 feet (Figure 4-13).

Porosity:

Calculated porosity from the SP/Induction log, is 33%.

Pressure:

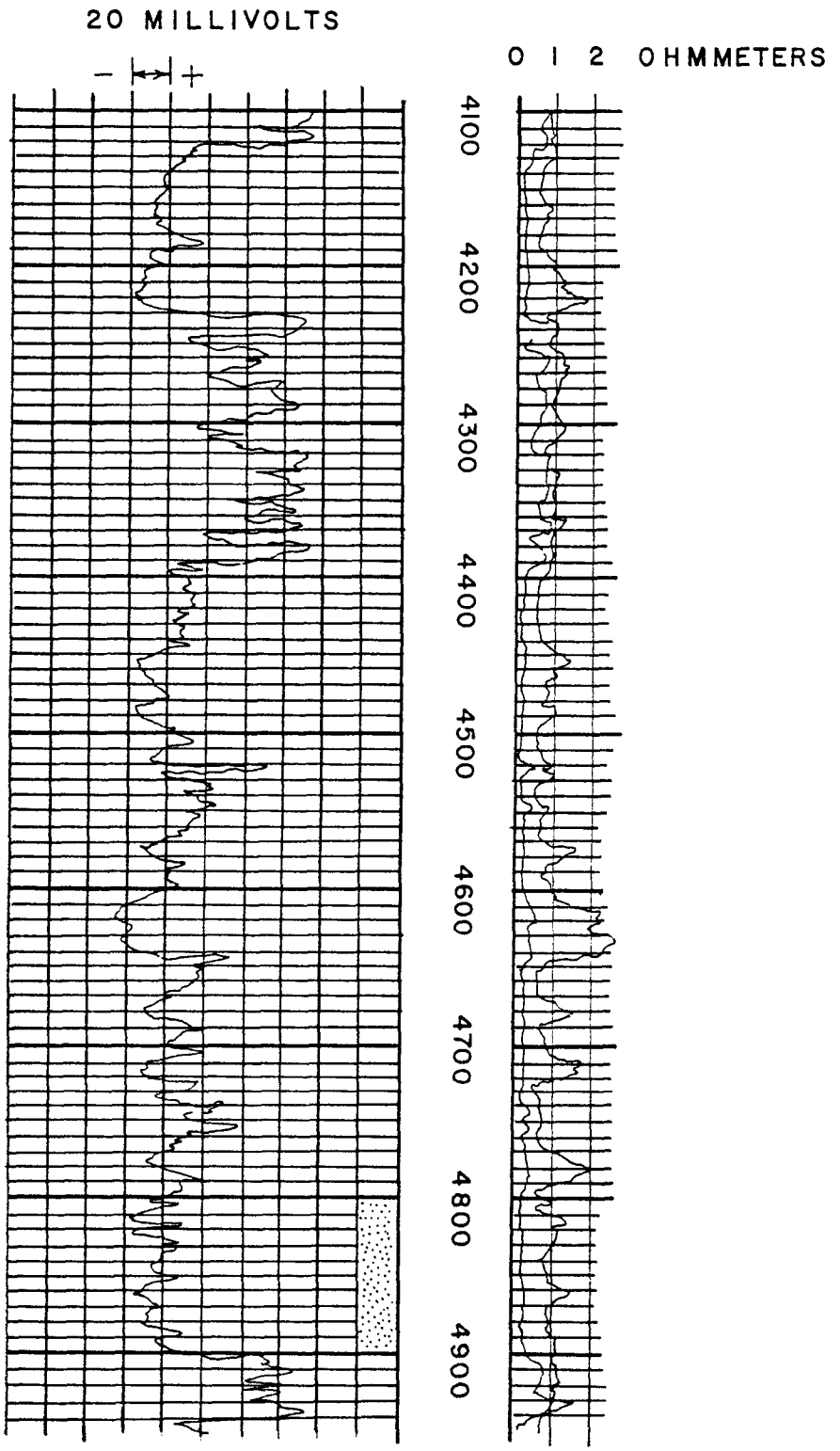
The average pressure in the target sand is estimated to be 2279 psi. This pressure was based on a gradient of approximately 0.465 psi/ft. and a reservoir depth of 4900 feet.

Temperature:

The average sand temperature is estimated to be 133°F based on a corrected temperature of 225°F at 14,174'.

Salinity:

Salinity is approximately 110,000 ppm based on calculations derived from the SP log.



SP/ ISF LOG SHOWING DISPOSAL SAND
CROWN ZELLERBACH NO. 1

FIGURE 4-13

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5.0 MANAGEMENT PLAN

This operation will be completely under the control of Eaton Operating Company, Inc. personnel who will be responsible for direction and coorination of all subcontractor functions. Each section will report directly to Mr. D. A. Langford. The Management and Organization Chart is shown on Figure 5-1 which is followed by a description of each position's responsibilities and authority.

Two competent, experienced rig supervisors and one experienced mud engineer will be assigned to the re-entry, clean out and completion operations under the direct supervision of Mr. J. E. Evans. A cost accountant property manager, under the direct supervision of Mr. Bill Rose, will be on location full time through rig up, re-entry, completion, testing and subsequent clean up. Quarters for these personnel will be located at the rig site.

Testing operations will be directed and coordinated by Mr. R. Z. Klauzinski. He will be responsible for engineering, reporting, technical conferences and technical papers.

Estimated daily and cumulative expenditures will be included in the daily report. Our finance and cost accounting group directed by Mr. G. E. Frey with the assistance of Mr. Bill Rose, will report actual incurred costs against estimated to Mr. D. A. Langford on a weekly basis.

The following pages set out Eaton's chart of accounts and also Eaton's planned method of cost control and weekly cost evaluation.

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MANAGEMENT PLAN ORGANIZATIONAL CHART

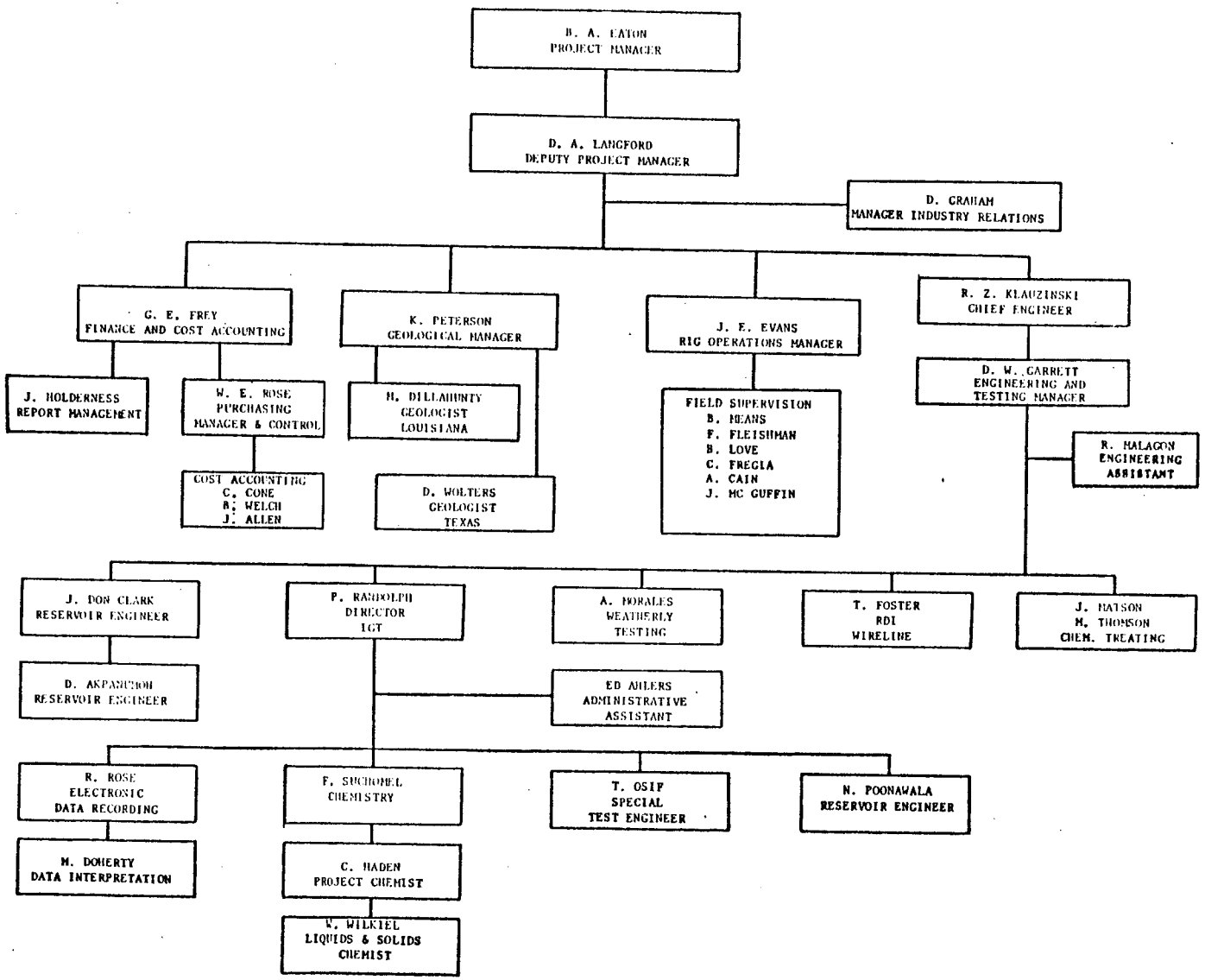

FIGURE 5-1

MANAGEMENT AND ORGANIZATION PLAN

TESTING OPERATIONS

PROJECT MANAGER (B. A. EATON)

Overall administrative and technical responsibility and authority of the Wells of Opportunity Program, i.e. development of policies and procedures, coordination of project activities, staff supervision, monitoring activities of contract organization to ensure proper cost control and organization and presentation of progress reports and briefings.

DEPUTY PROJECT MANAGER (D. A. LANGFORD)

Replace Project Manager in his absence, supervise performance of engineering, field operations and procurement managers. Responsible for discussions and negotiations with operator/leaseholder, obtain preliminary agreements for candidate wells and oversee preparation of all phases of reports and briefings (other than geologic).

CHIEF PETROLEUM ENGINEER (R. Z. KLAUZINSKI)

Responsible for engineering, reporting, technical conferences and technical papers.

ENGINEERING MANAGER (D. W. GARRETT)

Responsible for drilling, completion and surface facilities engineering, supervise review of candidate well conditions, supervise program schedules and cost estimates preparation, coordinate activities of subcontractor and supervise test program, data collection and reporting by assigned subcontractor or consultant.

ENGINEERING ASSISTANT (R. MALAGON)

Assist Engineering Manager in design and hook up of test equipment and on-site supervision of test program.

RIG OPERATIONS (J. E. EVANS)

Supervision of well completion for production test and drilling and completion of disposal wells. Supervision of field supervisors on completions and drilling operations.

FIELD SUPERVISORS

On-site rig supervision on re-entry, clean out, completions and disposal well drilling and completion.

GEOLOGICAL MANAGER (KIM PETERSON)

Supervision of geologists monitoring candidate wells, mapping areas of interest, discussion of plans with operator/leaseholder, supervise pre-evaluation and submittal of preliminary request for approval for candidate wells and assist in final evaluation and plan to D.O.E. for approval.

GEOLOGIST - LOUISIANA (MEG DILLAHUNTY)

Monitor progress of candidate wells in Louisiana, map areas of interest, determine if wells are suitable for evaluation, pre-evaluation work and preparation of recommendation to D.O.E.

GEOLOGIST - TEXAS (DOUG WOLTERS)

Monitor progress of candidate wells in Texas, map areas of interest, determine if wells are suitable for evaluation, pre-evaluation work and preparation of recommendation to D.O.E.

MANAGER INDUSTRY RELATIONS (DOUG GRAHAM)

Supervision of all information and reports pertaining to candidate wells, monthly progress and annual summations for submittal to D.O.E. Supervision of initial and follow-up contacts with operators and landowners and assist in agreement negotiations for both parties.

FINANCE AND COST ACCOUNTING (G. E. FREY)

Overall responsibility for accounting, finance, purchasing, contract compliance and administrative.

PURCHASING MANAGER CONTROL (W. E. ROSE)

Directs all purchasing, subcontracting and material control activity consistent with approved purchasing and inventory control procedures. He supervises the preparation of RFP and RFQ's, evaluation of bids and award of contracts and purchase orders. Additionally, he will monitor and report on his effort to implement the flow-down provisions of the contract to the subcontractor and vendors.

COST ACCOUNTING

Responsible for preparation of estimate for each well, as well as reporting actual expenditures and variance on each well.

RESERVOIR ENGINEER (DON CLARK)

Analyze flow test results and reservoir performance and assist in production test and reporting.

RESERVOIR ENGINEER (DANIEL AKPANUMOH)

Assist Don Clark in analyzing reservoir performance, flow test results and report writing. Assist EOC geologists in monitoring and evaluation of candidate wells and preliminary reports and recommendations.

DIRECTOR IGT (PHIL RANDOLPH)

Overall supervision of IGT personnel and operations.

WEATHERLY ENGINEERING TESTING (A. MORALES)

Supervision of production equipment hook up and equipment operation and data gathering personnel.

RESERVOIR DATA, INC. WIRELINE OPERATION (TAB FOSTER)

Supervision of wireline equipment and operating personnel.

CHEMICAL TREATING (J. MATSON, M. THOMSON)

Monitoring of scale and corrosion inhibitor requirements.

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TABLE 5-1

WEEKLY COST REPORT

REPORT NO.____

MARTIN - CROWN ZELLERBACH WELL NO. 2

Accounting Code	Item	Original Estimate	Spent As Of (Date)	To Be Spent After (Date)	Over(Under)
02	Field Labor	$ 106,000			
09	Site	269,000			
10	Drilling	421,000			
11	Tangible	741,000			
12	Expendables	346,000			
13	Cementing	117,000			
14	Perf, Acid	130,000			
15	Equip. & Tool Rent	131,000			
16	Contract Serv.	141,000			
17	Freight & Trans.	93,000			
18	Other	52,000			
19	Insurance	33,000			
20	Consultants	11,000			
21	Land Use	193,000			
24	Testing	617,000			
	TOTAL	3,401,000			

EATON OPERATING COMPANY, INC.
OPERATING COST CODES

01 Engineering & Management Labor
Home Office Labor directly associated with project.

02 Field Labor
Drilling Engineers, Drilling Suptn., Mud Engineers, and Dispatchers working on project in the field.

03 Payroll Burden
All taxes, insurance and fringe benefits in which calculation based on labor cost on project.

04 Travel
Air travel, car rentals, mileage reimbursement, meals, lodging and per diem compensation.

05 Automobile Expense
Auto lease, gasoline, oil, tires, maintenance, repairs, insurance, licenses and auto allowance.

06 Communications Expense
Internal telephone, in-house telecopier, telex, etc.

07 Office Copying
Charge for xerox rental and copies prepared by office employees.

08 Outside Reproduction
Charges for reproduction of documents or special printing of forms or photocopy of charts, graphs, maps, etc.

09 Site Preparation
Includes all clearing of road and access cost, road materials including board road material, maintenance of site including equipment and labor for site work. Clean up cost and land owner settlement in lieu of clean up.

10 Drilling Expense
Rig mobilization, day rate billing, stand-by or force majeure and demobilization.

11 Tangible Cost
Casing, tubing, well-head equipment, packers, tublar nipples, tie back sleeves and related repairs to this equipment.

Operating Cost Codes Continued -

12 Expendables
Water, fuel, mud and chemicals, bits and reamers, corrosive inhibitors.

13 Cementing
Cement pumping, mileage, labor and stand-by costs, cementing shoes, centralizers and all related costs.

14 Perforating, Acidizing, & Treating (completion of well)
Completion operations such as inside casing logging, coring service, testing, acidizing and fracturing, etc.

15 Equipment and Tool Rental
Includes - surface equipment, downhole drilling equipment, completion equipment.

16 Contract Services
Includes drive pipe, conductor casing, surface casing, intermediate casing, production casing, liner casing, mud logger tubing make up and wireline work.

17 Freight & Transportation
Cost of moving various materials to and from the site - right of way permits, overage load charges, tools for road bridges and tunnels - (Mobilization and demobilization of the rigs should be charged to drilling)

18 Other
Includes utilities, infield living quarters, trailer house, etc., and other miscellaneous direct costs.

19 Insurance
General Liability, well control and loss of revenue insurance directly related to a specific well.

20 Legal Fees & Consultant Costs
Cost of consultants charges including expenses. Retainer fee also included for consultants involved in project - legal fees directly associated with and performed on project.

21 Land Use and Owners Equity
Lease and bonus payment to land owners for lease option and payment to operator for equipment left on the well.

Operating Cost Codes Continued -

22 Office Supplies
Supplies needed for office, such as books, etc.

23 Rent Expense
Monthly rental at 3100 Edloe

24 Testing
Includes surface equipment and pressure vessels, pipe, fittings, wireline service for testing, labor for hooking up permanent materials, sub-contract cost for collecting, sampling and analysis work.

6.0 DELIVERABLES

Eaton will provide daily progress reports by telecopier to D.O.E. offices in Washington, Las Vegas, and Houston.

Eaton business office will provide weekly, bi-weekly, and monthly manpower and financial reports.

Eaton will prepare monthly technical reports which will provide preliminary interpretive data.

Eaton personnel will deliver talks or papers to industry or technical gatherings as appropriate.

Eaton personnel will interface with state and federal agencies other than D.O.E., including but not limited to the Environmental Protection Agency, Louisiana State University, Louisiana Department of Natural Resources, and the Bureau of Economic Geology at The University of Texas.

Eaton will furnish a final report summarizing all well and test activity and giving results of all engineering calculations on fluid flow, chemical and physical composition, fluids, reservoir behavior, reservoir boundaries, and all other chemical or physical data.

7.0 LOCATION AND FACILITIES

7.1 Site Layout

The present site layout is illustrated on Figure 7-1. The location is adequately covered with boards and a reserve pit is located as shown. A drainage ditch surrounding the location will trap waste oil and grease spillage which will then be disposed of so that no oil spill will contaminate the area.

7.2 Living Quarters

Air-conditioned living facilities will be provided for six individuals. This will be in addition to rig contractor's living facilities. The quarters will remain on location as long as necessary and will contain the communications equipment.

7.3 Water Supply

A water well will not be necessary at this location. All water used for completion, drilling and drinking will be piped in from the Crown Zellerbach plant which is about one-half of a mile from the site. The water is part of the community fresh water system.

7.4 Communications and Power

A telephone line extends up to the edge of the location and a telephone with appropriate extension phones will be installed in all living facilities.

During drilling and completions, the rig should have an adequate 110-volt power system to meet all anticipated requirements. During the testing

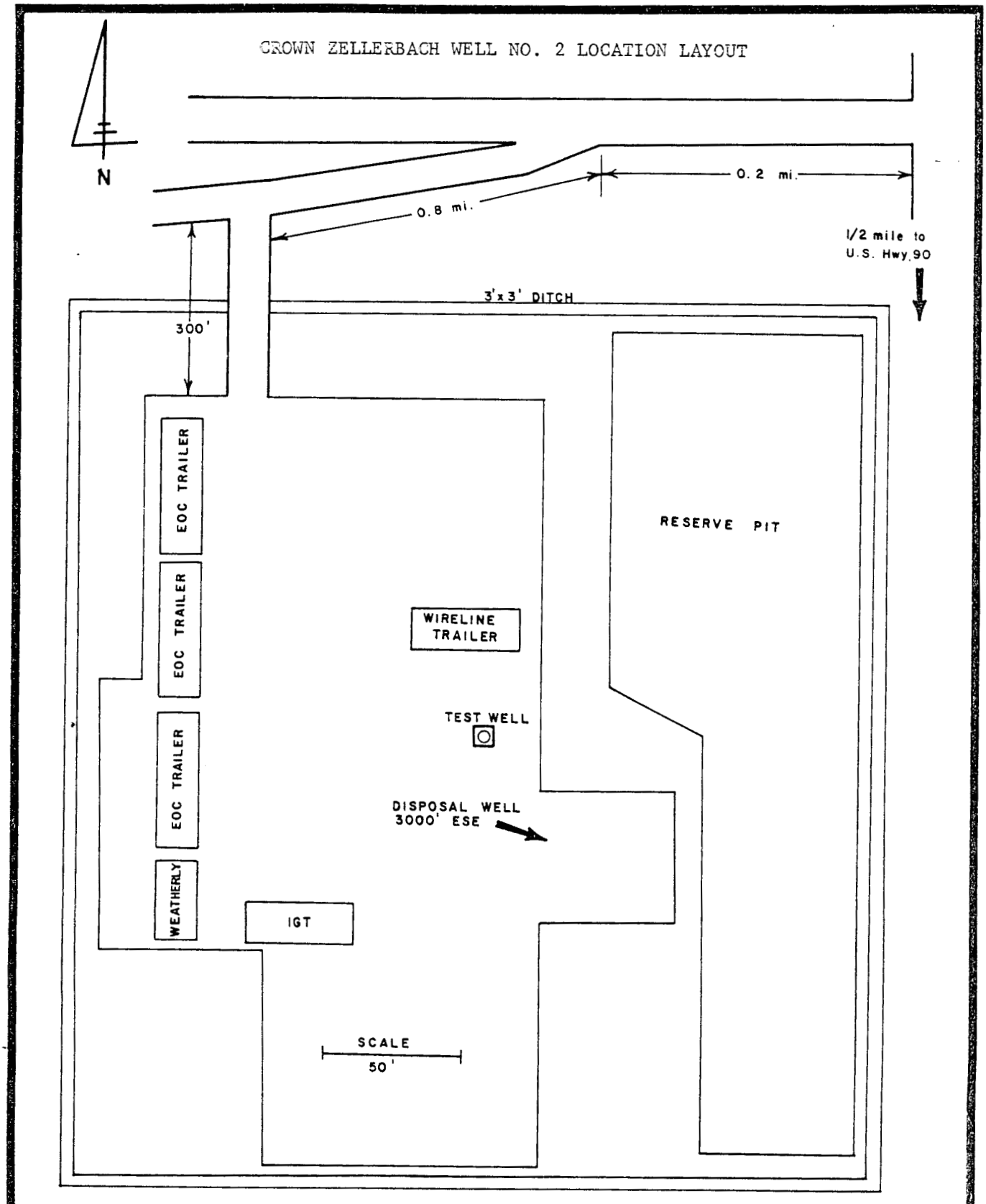

FIGURE 7-1

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operations, a power line will be extended to bring electric power from a nearby commercial source. Rental generators will be used, if necessary.

7.5 Site Cleanup and Restoration

At the termination of the test, all test equipment will be removed. A workover rig will be moved in to salvage the tubulars and to plug and abandon the test well and the disposal well in accordance with the rules of the Louisiana Office of Conservation. The workover rig will then be released. The reserve pit will be filled in, the boards removed and the site restored to the satisfaction of all concerned parties.

8.0 RE-ENTRY AND COMPLETION OPERATIONS - TEST WELL

8.1 Rig Selection

The contractor to be selected for the proposed re-entry and completion work will be chosen on the basis of experience, equipment, competitive price and availability. Consideration of the ability to supply a rig to meet the specified requirements and to furnish qualified personnel will be a primary factor in the selection. Each available rig will be inspected and a review of its past performance will be made by EOC before finalizing a contract.

The minimum requirements for the rig will be as described below:

A. Derrick Hookload Capacity: 700,000 lbs.

B. Power Available For Drawworks: 1,100 HP

C. Main Pumps: One 1,000 HP Mud Pump and One 800 HP Mud Pump

D. Rotary: 20-1/2 Inches

E. Substructure Height: 19 Feet

F. Drill Pipe: 10,000' of 4-1/2" 16.6#/Ft. Grade E

Other drill pipe will have to be rented.

G. Mud System: 500 Barrel capacity with steel tanks, mud mixing pumps and agitators.

H. Blowout Preventor (BOP) System:

1. Two Ram Type 5,000 PSI WP with Extra Rams
2. One Bag Type 5,000 PSI WP with Extra Bag
3. Kill Manifold with Power Operated Choke and Adjustable Choke

4. BOP Closing Unit with ability to close in 15 seconds. Sufficient capacity must be available to close, open, and close again BOP and one ram BOP.

5. Two Station Closure for BOPs.

Note: All BOP equipment must be suitable for H_2S service. Extra rams and extra bag would be rented.

I. Accessories:

1. One air conditioned bunk house.
2. Two diesel electric generators.
3. Two lower kelly cock safety valves and one inside blowout preventer safety valve. These items may have to be rented.
4. Any other items EOC may consider necessary for a complete rig.

8.2 Drilling and Workover Fluids

This well was drilled using a 13.8 ppg oil based mud. A water based 10.0 ppg mud will be used until the top of the cement plug at 14,000' is reached. The mud will then be displaced by a 13.8 ppg oil based mud. The oil based mud will be stored on location when it is not in use.

The following discussion will explain why an oil based mud is recommended on this well.

Both the hydrogen and sulfide components of hydrogen sulfide are instrumental in bringing about the sudden and sometimes spectacular failures in the drill.

string that are attributed to this contaminant. Hydrogen sulfide may enter the mud system from formation of fluids that contain H_2S, from bacterial action on sulfur compounds commonly present in the drilling mud, from thermal degradation of sulfur containing drilling fluid additives (such as lignosulfonates), or from chemical reactions with tool joint thread lubricants that contain sulfur. Hydrogen may be generated in drilling fluids by the corrosion process, by bacterial action, and by thermal degradation of organic additives.

In the absence of sulfide, hydrogen collects on the pipe surface as a film of atomic hydrogen which quickly combines with itself to form molecular hydrogen gas (H_2). The hydrogen gas molecule is too large to enter the steel and therefore usually bubbles off harmlessly. Under normal conditions, only a small amount of hydrogen enters steel and seldom causes trouble. In the presence of sulfide, however, the hydrogen gradient into steel is greatly increased and catastrophic damage often results from hydrogen embrittlement. The sulfide and the higher concentration of hydrogen atoms work together to maximize the number of hydrogen atoms that enter the steel.

Once in steel, hydrogen tends to concentrate in areas of maximum stress. When hydrogen causes small cracks that lead to sudden brittle failure, the failure is called hydrogen embrittlement, hydrogen stress cracking, or hydrogen-induced delayed brittle failure. When sulfide is present the failure mode is usually called sulfide stress cracking. The presence

of atomic hydrogen in steel reduces the ductility of the steel and causes it to break in a brittle manner. Hydrogen may also accumulate as molecular hydrogen at internal discontinuities or voids, creating blisters or fissures that lower the strength of the steel.

Relatively soft steels with low-yield strengths are generally resistant to sulfide stress cracking. These limits may be extended slightly by special treatment of the steel, but nevertheless as steel strength is increased, the critical stress and time-to-failure both decrease.

The amount of atomic hydrogen required to initiate sulfide stress cracking appears to be small, possibly as low as 1 ppm. But sufficient hydrogen must be available to establish a diffusion gradient or driving force in order to produce the critical concentrations required to initiate and propagate a crack. As more hydrogen is generated from corrosion processes, bacterial action and/or thermal degradation, accumulation of hydrogen in maximum stress areas occurs. Large amounts of sulfide increase the amount of atomic hydrogen present, thus increasing the force that drives the hydrogen into the steel.

The amount of atomic hydrogen and the length of time it exists in that state increases with sulfide concentration. Hence with high sulfide concentration, failure time is shortened, and the strength level at which cracking occurs declines. Laboratory tests show that H_2S concentrations as low as 1-3 ppm will ultimately produce cracking in highly stressed high-strength steels.

Hydrogen generation depends on the pH environment. Low pH values increase hydrogen availability. At all pH values of less than 6 or 7, time to failure in the presence of H_2S is usually less than an hour. As pH increases to 8 and higher, time-to-failure increases rapidly to 100 hours and more.

Corrosion pits, tong marks, notches and other defects raise the stress in local areas, thereby accelerating hydrogen diffusion and shortening time-to-failure. When steel is cold-worked, residual stresses develop which may add to working stresses and shorten time-to-failure.

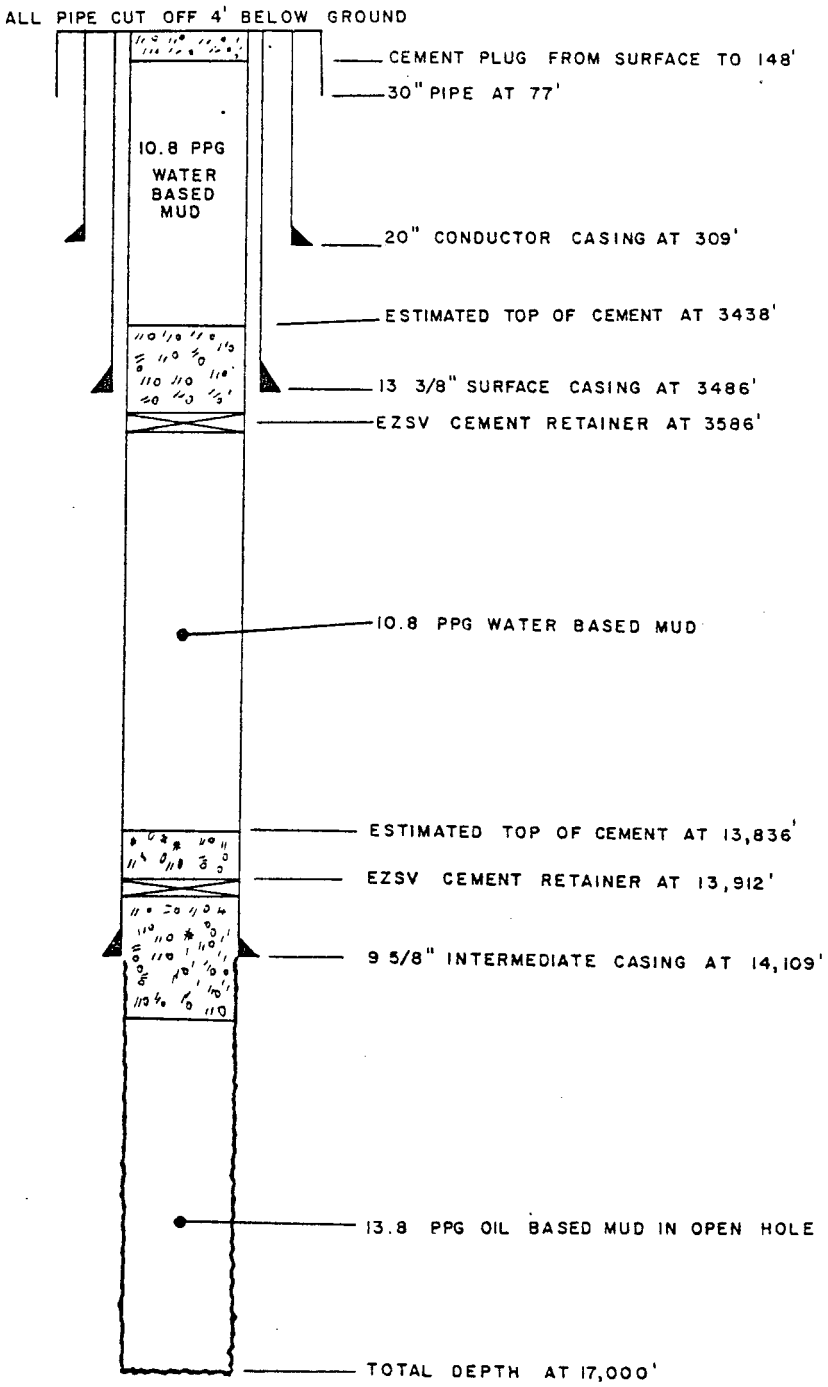
The rate of corrosion increases with temperature, but susceptibility to cracking may decrease at temperatures above 150°F. Until a steel containing hydrogen actually cracks, there is no permanent damage. In many cases, the hydrogen can be baked out by suitable heat treatment and the original properties of the steel restored.

It will be apparent from the preceding discussion that the handling and metallurgy of the drill string are fundamental factors in combating damage from H_2S. Much can also be done to alleviate the hazards created by this dangerous contaminant through drilling fluids technology. Dependable protection of the drill string from damage by H_2S can be obtained through the use of a properly formulated and conditioned oil mud.

8.3 Tubular Goods and Cementing Design

Figure 8-1 on Page 64 is a schematic of the well in its present condition. There are approximately 600 feet of cement plugs and two cement retainers in the well.

MARTIN-CROWN ZELLERBACH WELL NO. 2



PRESENT CONDITION

FIGURE 8-1

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Figure 8-2 is a schematic of the proposed completion of the well for testing. Once the well is cleaned out, 7 inch O.D. production casing will be run to total depth of 17,000 feet. The production casing will be cemented to provide at least 1,000 feet of cement mixture above the bottom of the 9-5/8 inch intermediate casing to insure a seal.

Annular flow of fluids is planned for this test so that the wireline tools will not be exposed to turbulence, scaling and excessive corrosion.

The designs for all tubular goods used in completing this well are based on the "maximum load" concept widely used in the oil and gas industry. The buoyancy of the mud at the time of casing setting is incorporated into the tension design criteria. Figures 8-3, 8-4, and 8-5 are graphical illustrations of the casing design curves.

During testing, the temperature increase of the 7 inch casing will result in an increase in length of about 10.9' and a reduction in the wellhead weight load of 252,600 pounds. This temperature effect can be neutralized by pulling additional weight on the casing after the cement has been allowed to set.

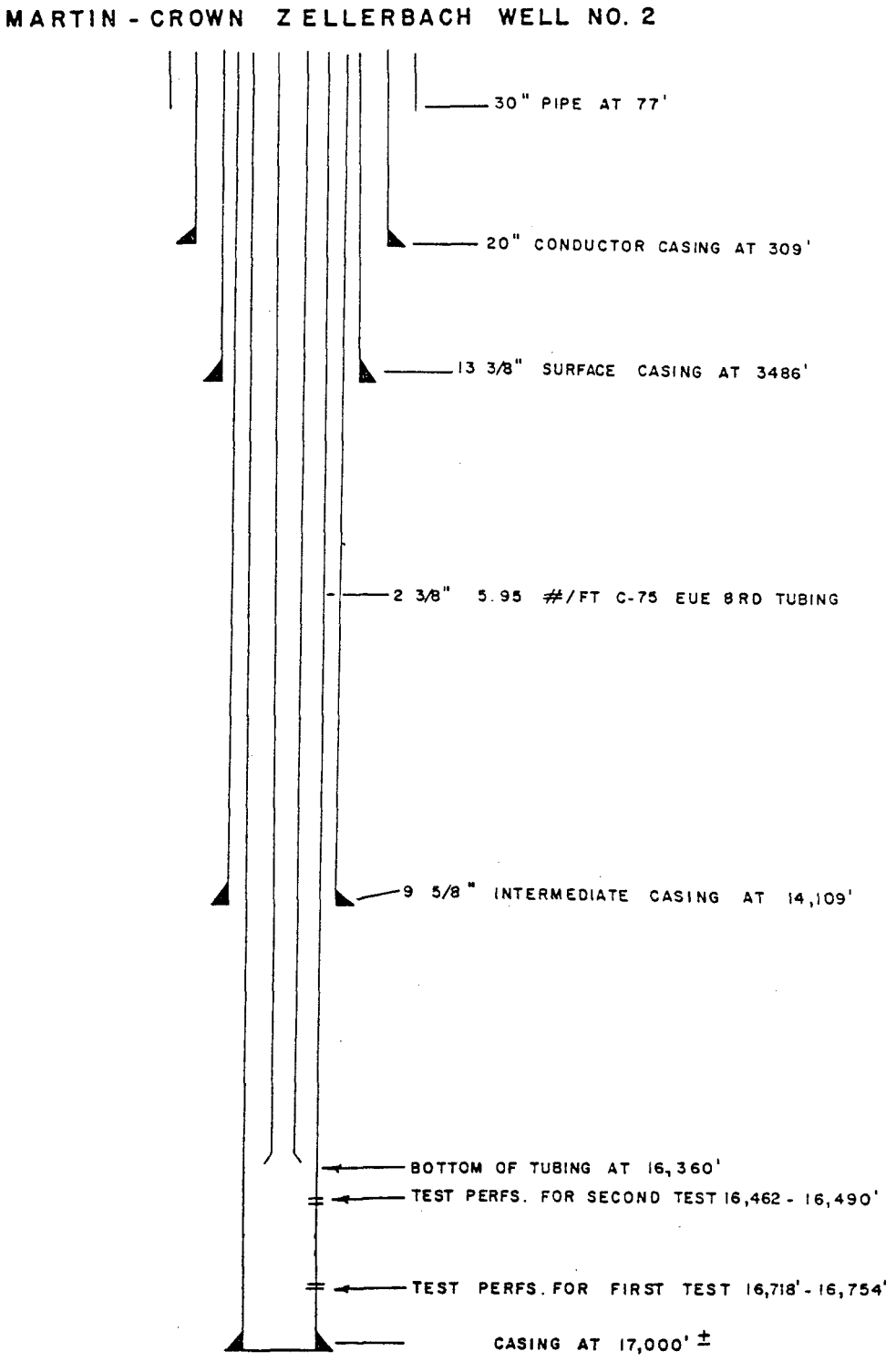

FIGURE 8-2

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The temperature calculations are shown below.

Assume surface temperature is 70°F.

Bottom hole temperature is 297° at 16,736'.

Assume surface temperature is 275° with well flowing.

Assume temperature of uncemented portion of casing before flow is:

$$(297 - 70) \div 16{,}736 \times \frac{12{,}000}{2} + 70 = 151^{\circ}$$

Average temperature of uncemented portion of casing during flow is:

$$(297 - 275) \div 16{,}736 \times \frac{12{,}000}{2} + 275 = 283^{\circ}$$

$$\Delta T = 283 - 151 = 132^{\circ}$$

Change in Length of 7" Casing Due to Temperature

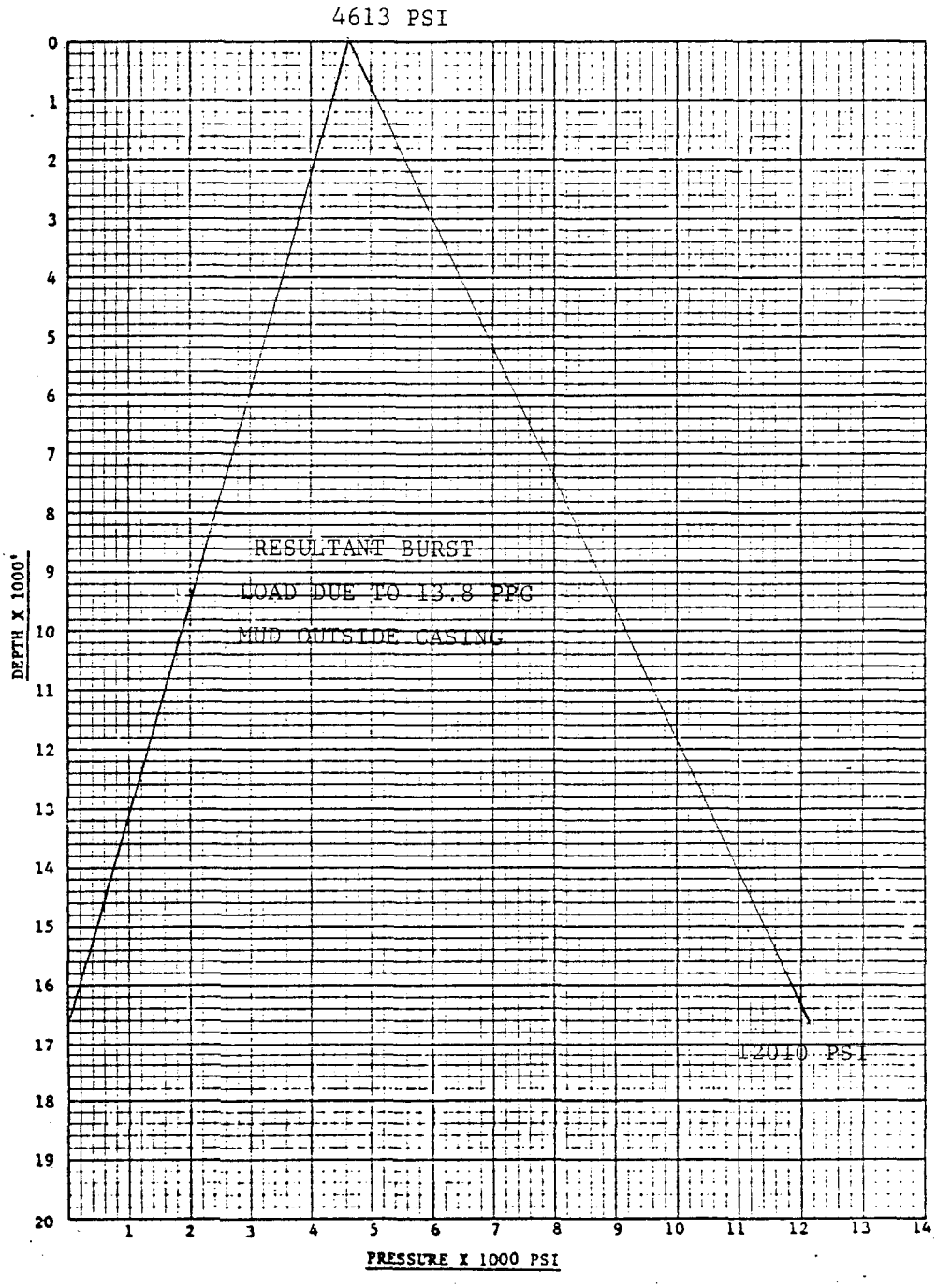
$L_t = LB\Delta T = 12{,}000 \times .0000069 \times 132 = 10.9'$

Change in Wellhead Load Due to Temperature

Average weight of casing above 12,000' is: 32#/Ft.

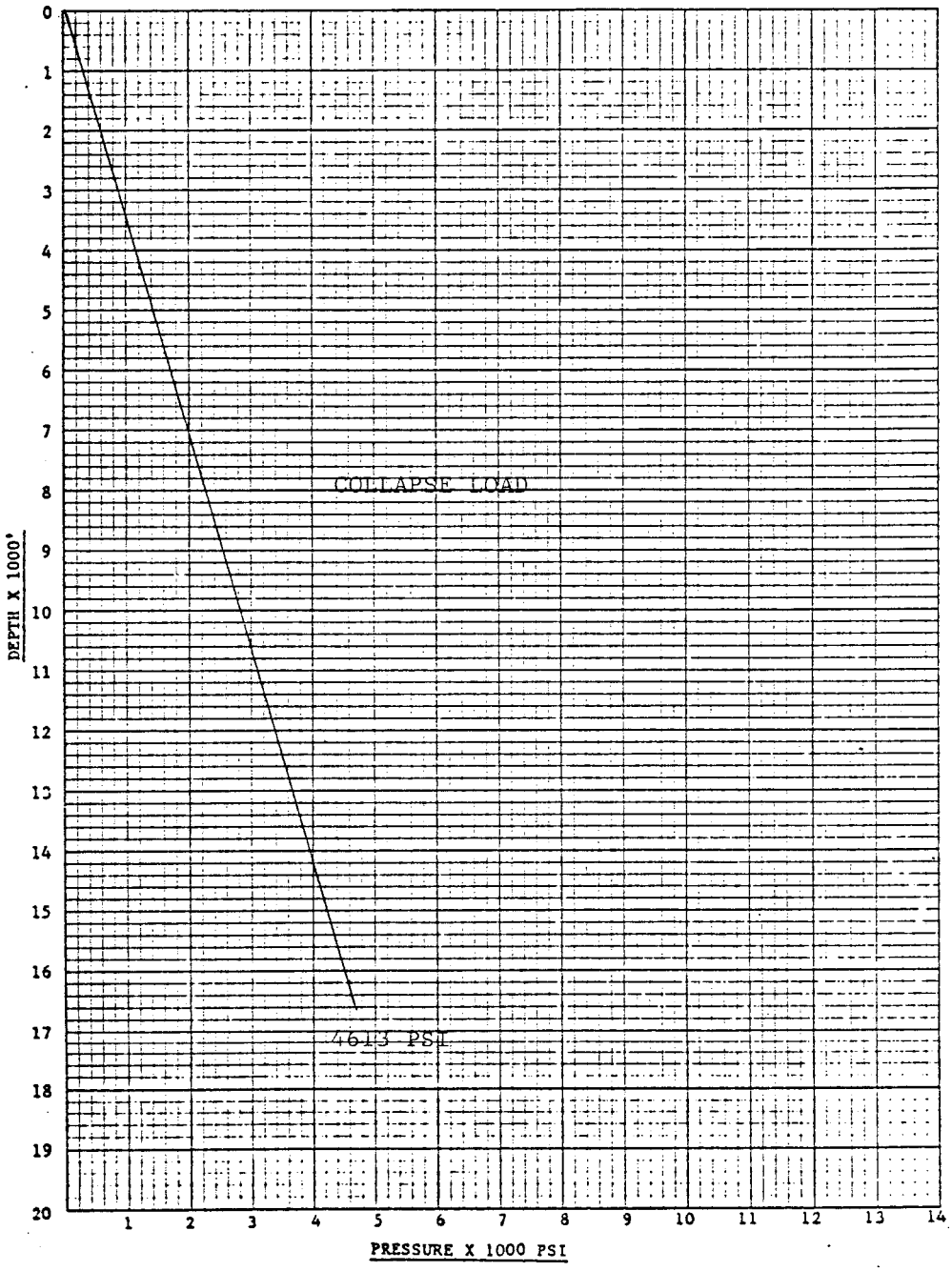
From equation on Cox nomograph wellhead load is:

$$W_2 = -59.8\ W\Delta T = (-59.8)\ (32.00)\ (132) = -252.595$$



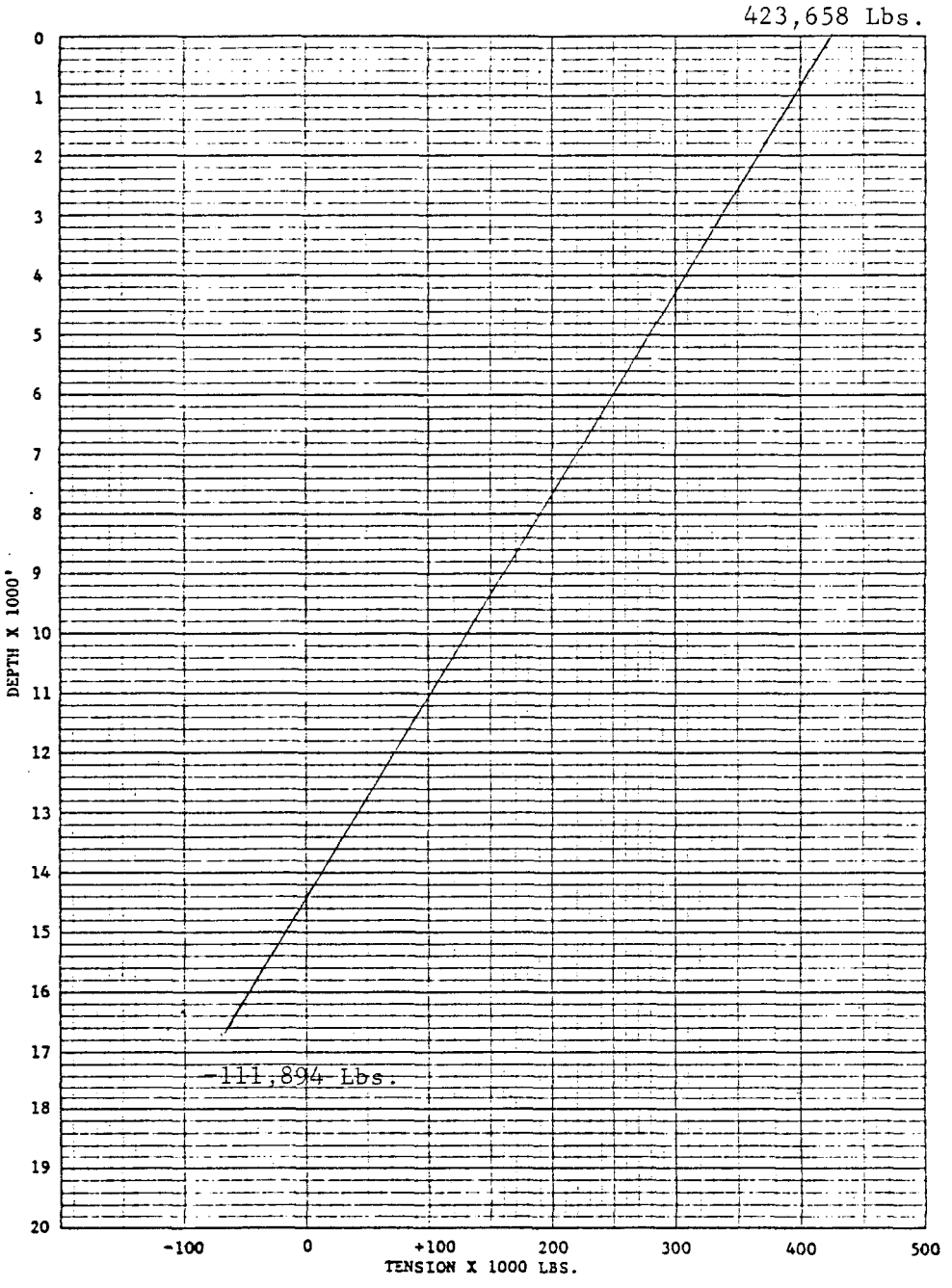
Burst Calculations: 7" Casing
Assume casing is set in 13.8 PPG mud and casing is full of 8.5 PPG salt water. Assume bottomhole pressure is equal to 12,010 PSI at 16,736'. Maximum surface pressure = 12,010 - (8.5 x 0.052 x 16,736) = 4613 PSI

Figure 8-3



Collapse Calculations: 7" Casing
Assume casing is set in 13.8 PPG mud and full of 8.5 PPG salt water with no surface pressure collapse load at 16,736' = (13.8 - 8.5) x 0.052 x 16,736' = 4,613 PSI

Figure 8-4



Tension Calculations: 7" Casing

Bouyancy Force = Hydrostatic Pressure x Cross Sectional Area.
At 16,736' BF = 13.8 x 0.052 x 16,736 x 9.317 = -111,894
Tension at surface = (32 x 16,736) - 111,894 = 423,658#

Figure 8-5

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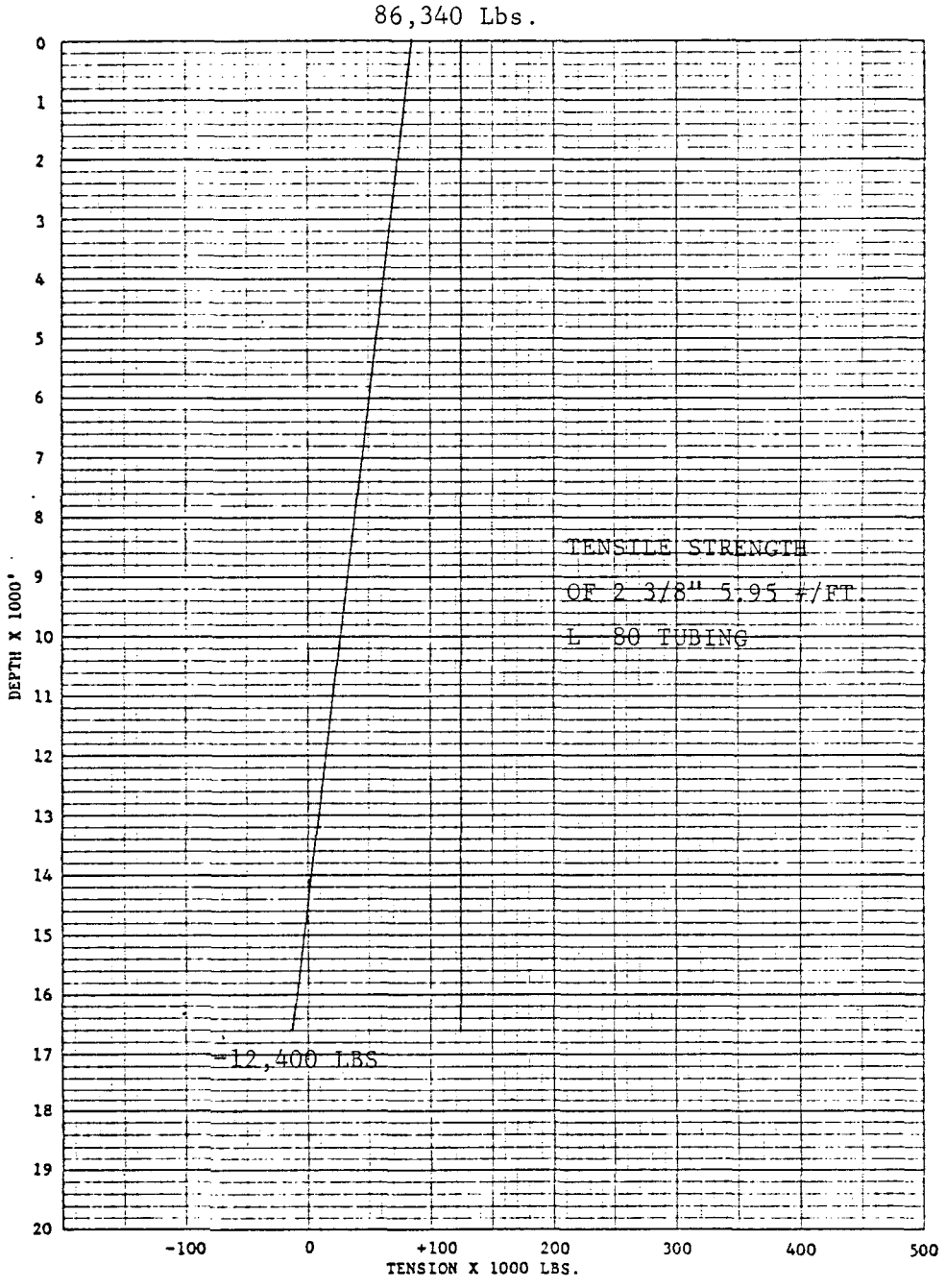
The tubing will not be set on a packer because the well will be flowed up the annulus between the casing and the tubing. The burst and collapse pressure on the tubing will, therefore, not be significant because pressure forces inside and outside the tubing will be essentially the same. The tension design curve is based on the buoyancy of salt water as illustrated on Figure 8-6.

The production casing and tubing will be exposed to H_2S and CO_2 during testing. Stress corrosion cracking is more likely to occur in the cooler areas of the well, such as the upper section of the well where the temperature can be less than 175°F. Stress corrosion cracking can be avoided in areas where the temperature is less than 175° through use of resistant tubular goods. A static temperature profile curve has been prepared for this well using log temperature data. Figure 8-7 indicates that the static temperature at 7,600' is 175°. All tubular goods set above 7,600' must be resistant to stress corrosion cracking. As an additional safety consideration, all of the 7 inch casing and 2-3/8" tubing will be stress corrosion resistant to prevent a problem from occurring due to mixing or mishandling of pipe.



Tension Calculations: 2 3/8" Tubing

Bouyancy Force = Hydrostatic Pressure x Cross Sectional Area.

At 16,600' BF = 8.5 x 0.052 x 16,600 x 1.69 = -12400 Lbs.

Tension at top = (5.95 x 16,600) - 12,400 = 86,370 Lbs.

Figure 8-6

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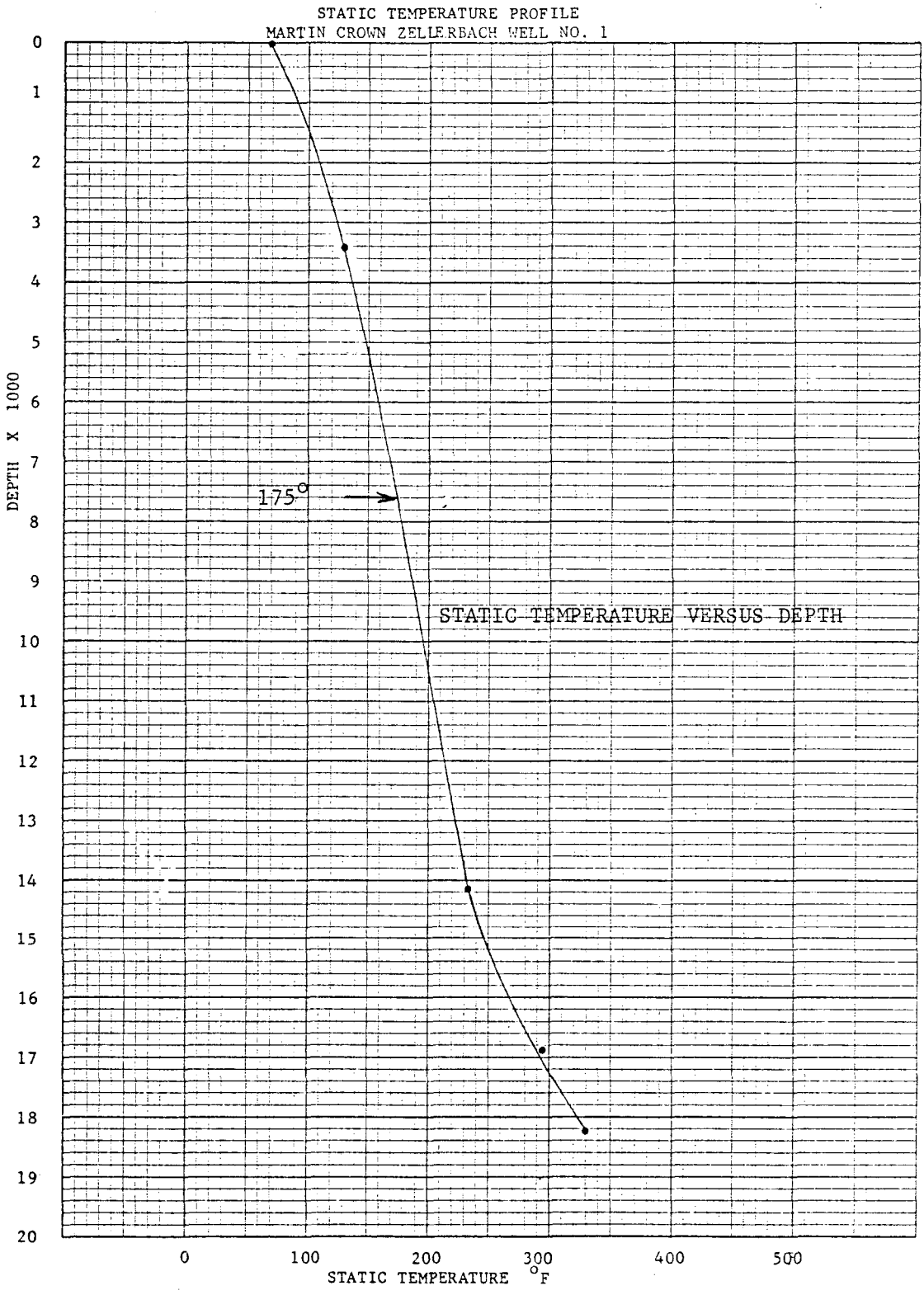

FIGURE 8-7

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Table 8-1 shows the specifications for the tubular goods installed or planned for use in the test well, as well as hole size, auxiliary casing equipment, design safety factors and minimum test pressures.

8.4 Recording Instruments

The rig will be equipped with the following items.

A. Pit level recorder.

B. Mud pump pressure recording gauge.

C. Mud pump stroke counter and mud volume totalizer.

D. Mud return line activity recorder.

E. Gas detector with alarm.

F. Rotary table torque indicator.

G. Tong tubular makeup torque indicator.

H. H_2S gas detection equipment as necessary.

8.5 Well Control

A typical program for hookup, test procedures and maintenance of blowout prevention equipment is outlined below. Routine blowout preventer drills will be conducted at specified intervals when out of the hole. There will also be unscheduled drills to check the reaction time of the crews and to keep them alert as to possible blowout conditions. A trip tank will be installed and monitored during critical operations. A power operated Swaco Super Choke will be installed as a part of the main blowout preventer equipment.

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TABLE 8-1
MARTIN-CROWN ZELLERBACH WELL NO. 2
TUBULAR GOODS SUMMARY

Tubular	O.D. Size (in.)	Depth From (Ft.)	Depth To (Ft.)	Weight lbs./Ft.	Minimum Drift (in.)	Casing Description Grade	Casing Description Thread	Casing Design Factors Burst	Casing Design Factors Collapse	Casing Design Factors Tension
Conductor Pipe	20	0	309	NA	NA	NA	NA	*	*	*
Surface Casing	13-3/8	0	3,486	61	12.359	NA	NA	*	*	*
Intermediate Casing	9-5/8	0	14,109	53.5	8.500	NA	NA	*	*	*
Production Casing	7	0	8,000	32	5.969	L-80	LT&C	1.96	**	1.56
		8,000	17,000	32	5.969	P-110	ABM	**	2.33	**
Tubing	2-3/8	0	16,360	5.95	1.773	L-80	DWS	**	**	1.57

CEMENTING SUMMARY

Casing	O.D. Size (in.)	Hole Size (in.)	
Surface	13-3/8	17-1/2	2,390 Sacks Lite cement with 3% salt followed by 400 sacks Class H cement.
Intermediate	9-5/8	12-1/4	1,500 Sacks HTLD cement with 1.7% halad 22-A, 0.2% Econolite, 0.25% Kwikseal and 0.6% HR-5, followed with 1,000 sacks class H cement with 35% silica, 0.75% CFR-2, 0.4% halad-22A and 0.3% HR-5. Cemented around top of 9-5/8" by 13-3/8" annulus with 1,000 sacks of cement.
Production	7	8-1/2	To be cemented from 17,000' to 12,000'. Cement to be determined.

Note: All pipe except 7" casing was cemented and tested by Martin Exploration. The 7" casing will be tested at pressures much higher than the 3,120 psi required by the State of Louisiana.

* Tubulars in place and/or will not be exposed to well bore conditions.

** Safety factors very high or no longer exposed to well bore conditions.

A. Blowout Prevention Equipment - It is the policy of EOC to always have adequate blowout prevention equipment at each well location. The policy is also to have this equipment in first class operating condition with frequent testing required.

The following section lists the general requirements for the selection, use, and testing of blowout prevention systems to be used on all EOC wells while drilling.

1. Selection and Specification - will be given in the well program. Selection by the drilling engineer is based on the following:
   a. Burst rating of casing
   b. Test pressure of casing shoe
   c. Maximum possible surface pressure
2. Installation and Use - selection is the easy part, installation and use is what counts.
   a. Installation is the complete responsibility of drilling foreman.
   b. Installation should comply with the drawings and specifications detailed in this section.
   c. Use of the BOP equipment should consider the selection criteria above, especially (1) burst pressure and (2) shoe pressure.
3. Classification - Two preferred systems can be used on this well.
   a. High Pressure
      1. one hydril "GK", 5000 psi or equivalent.
      2. One blind ram type preventer, hydraulically operated.

TYPICAL BLOWOUT PREVENTER INSTALLATION

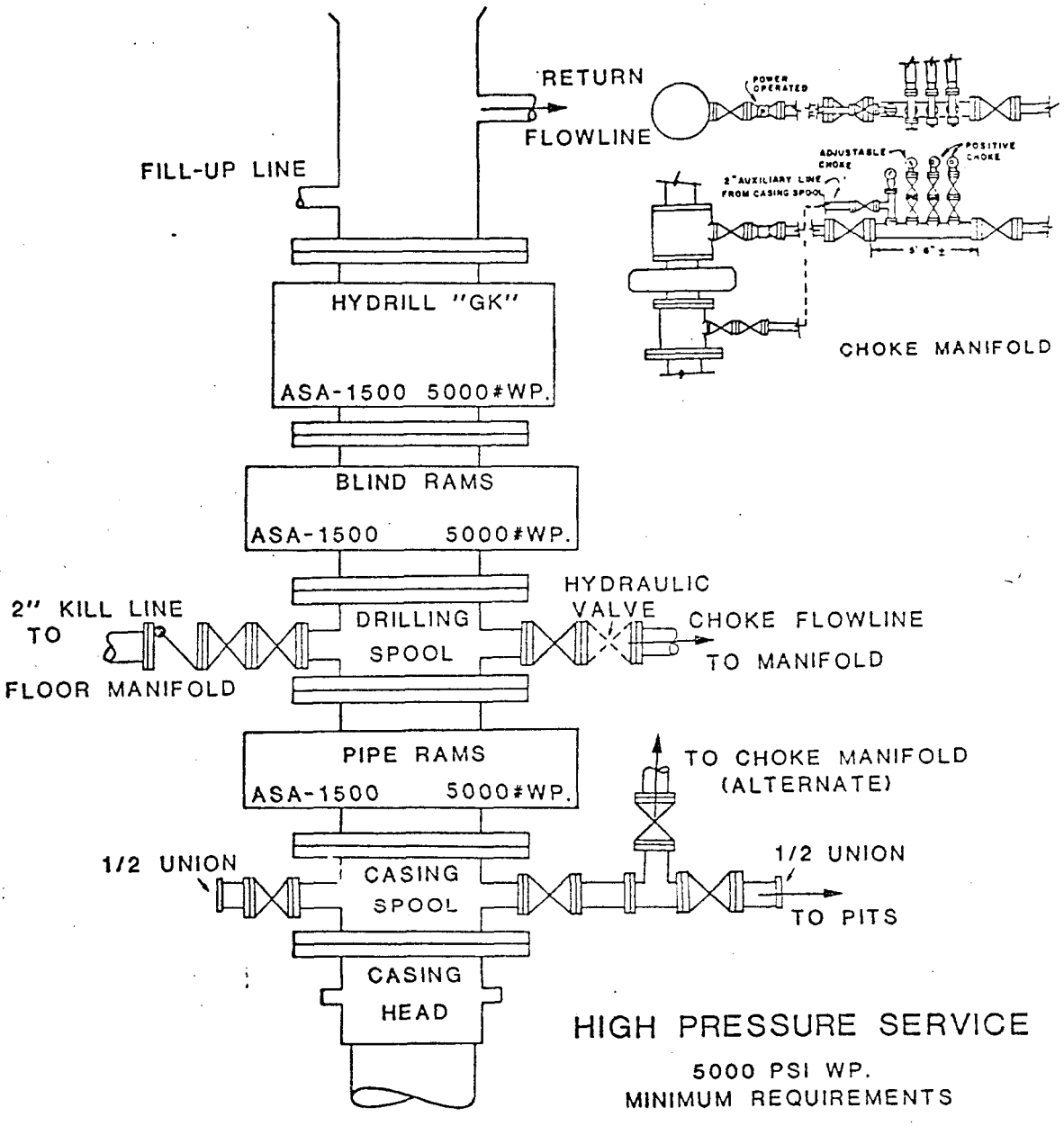

Figure 8-8

3. One drilling spool with choke and kill lines as indicated on Figure 8-8. Note dual gate valves on kill lines.

4. One pipe ram type preventer, hydraulically operated.

5. Nippled up on casing spool.

6. Alternate kill and relief lines may be connected to either the casing spool or to flanged outlets of bottom ram preventer.

7. Extra pipe or casing rams as needed.

8. Choke manifold as Figure 8-8.

b. Abnormal High Pressure

1. One hydril "GK" (either 5000 psi or 10,000 psi as noted in well program) or equivalent.

2. One pipe ram preventer, hydraulically operated.

3. One blind ram type preventer, hyraulically operated.

4. One drilling spool with choke and kill lines as indicated on Figure 8-9. Note dual gate valves on kill lines.

5. One pipe ram type preventer, hydraulically operated.

6. Nippled up on casing spool.

7. Alternate kill and relief line may be connected to either casing spool or to flanged outlets of bottom ram preventers.

8. Choke manifold as in Figure 8-9.

9. Extra pipe or casing rams as needed.

4. Auxiliary and Associated Equipment

a. Drilling Spools - shall be forged steel, full opening, with one 4-inch and one 2-inch flanged (or preferably studded) side outlets.

TYPICAL BLOWOUT INSTALLATION

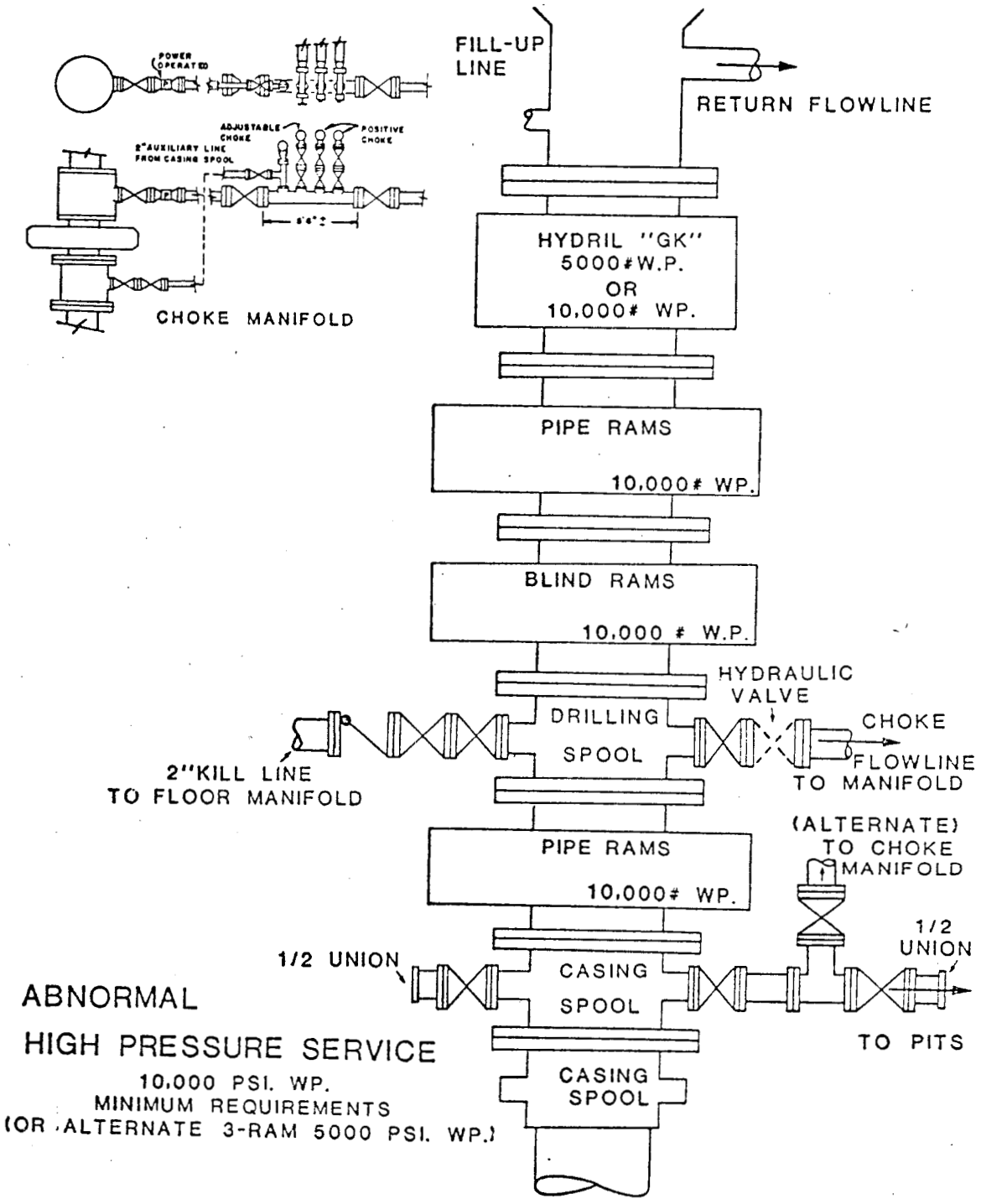

Figure 8-9

b. Choke and Kill Valves

1. All steel, flanged valves.
2. Valves should correspond in size to the flanges of the drilling spool.
3. No adapters to be used in nippling up valves.
4. Valves must be for both gas and fluid service, therefore valves with rubber seats are not approved.
5. Valves adjacent to spool should be kept open and only used for emergency.

c. Accumulator and Control Equipment

1. Koomey or Payne, 3000 psi W.P. with regulator valves to 1500 psi maximum for hydril and rams.
2. Capacity to close, open, and close again the hydril and one ram without recharging accumulator.
3. Both primary and alternate power sources to fluid pumps.
4. Compressors for air pumps must be a minimum of 100 feet from rig floor.

d. Control Piping -- steel piping with Chiksan joints or high pressure hoses (3000 psi W.P.) are acceptable.

e. BOP Control Station - two control stations clearly marked showing open and closed position for each BOP function and the pressure operated choke line valve.

1. One control station near driller, other station at safe distance from well.

2. Blind ram control to have easy to remove locking or protective cover system to prevent accidental operation.

f. Adapter Spools/Flanges - although sometimes necessary in connecting BOP's to the casing head, they are not desirable in that this would constitute another joint that might leak.

g. Choke Manifold - A preferred manifold is included in the drawing of each type BOP stack.

1. In an easily accessible location.
2. Working pressure equal or greater than BOP equipment.
3. Avoid stiff connections to wellhead.
4. Preferred choke flowline of 3-1/16" ID.
5. All right angle turns to be made of bull plugged tees or crosses where flow direction is changed.
6. Pressure sensor for hydraulic adjustable choke should be near wellhead.

h. Upper Kelly Cock - (left-hand Kelly Cock) on top of Kelly. Requires frequent greasing and testing.

i. Lower Kelly Cock - (right-hand Kelly Cock) - two (2) hydril type lower Kelly Cocks for each size of drill pipe in hole shall be on the rig.

j. Test Sub - for testing the Kelly cocks from the bottom side shall be on the rig floor.

k. Kelly Saver Sub - installed below Kelly with a proper size rubber casing protection.

l. Cross-over Subs - drill pipe box by drill collar pin, to use if kick occurs while handling collars.

m. Rotating Type Circulating Head - a 3" 5000 psi head with proper bottom subs for drill pipe.

n. Inside BOP - Gray, TIW, or Shaffer with proper subs should be at driller's console for immediate use.

5. Recommended Practices and Procedures

a. Screwed valves and fittings shall not be utilized in the BOP-Manifold system.

b. Kill line shall not be used for routine fill-up operations.

c. Casing head outlets shall not be used for choke or kill purposes except in emergency.

d. Pump through choke and kill lines on each trip.

e. Use hole cover when pipe is out of hole.

f. Open and close pipe rams each trip or daily.

g. Open and close kelly cocks each trip.

h. Check and record on IADC report accumulator pressure each tour.

i. Check hydril rubber position prior to running new bit.

j. Check for (1) kelly cock wrench, and (2) inside BOP at driller's console each tour.

k. Choke and kill valves immediately adjacent to spool or casing head should be kept in open position and only used in emergencies.

l. All valves should be equipped with handwheels and ready for immediate use.

m. Replace mud in choke and kill lines with anti-freeze during freezing conditions.

n. Casing rams will be installed for running 9-5/8" and smaller casing.

o. Casing and pipe rams will be installed in a 3-ram BOP prior to running a liner. If BOP is of the 2-ram type, rams to fit the liner will not be installed, but a drill pipe by casing swedge will be on the floor.

6. Testing Practices

a. Frequency - the entire BOP system including manifold, flow lines, kelly cocks, swivel standpipe, and rotary hose will be tested:

1. Upon initial installation
2. Each 7 days thereafter
3. Prior to drilling into a known abnormal pressure zone.

b. Test Pressure - all components of the BOP system with the exception of the hydril shall be tested to its full rated working pressure. The hydril (annular) preventer will be tested to 70% of its rated working pressure.

c. Plug-Type Tester - shall be used to test the BOP system and well head components.

1. Water shall be used for testing after having displaced the mud to a point just below the casing head or spool.
2. Open valve on spool below test plug to prevent pressurizing the casing should the plug leak.
3. Blind rams shall be tested by converting the plug to a blind plug and backing out the drill pipe. Note: Be sure valve or

spool side outlet is opened.

d. Test Sub - should be used to test kelly cocks, kelly and swivel from bottom side.

e. Casing - will be tested.

1. Prior to drilling out

2. Each 7 days after drilling out, utilizing a cup-type plug tester set at ± 150'

f. Test Procedures - BOP's, choke manifold, kelly cocks, swivel hose, and standpipe. The object is to test each valve and BOP ram in both the open and closed position. We not only want to know if the flanges on either side of a valve are good, but we need to know if the valve or ram will hold its rated working pressure when closed with atmospheric pressure on the other side.

Step 1. Drain mud from manifold, lines, and BOP's. Refill with fresh water.

Step 2. Pick up and run plug type tester and ported sub, open casing head valve or auxiliary valve below test plug. Open all valves (and HCR) from BOP to choke line and back to manifold. Close all chokes or outer valves leaving manifold. Close Hydril on drill pipe and pressure test entire stack, lines, and manifold to 70% of Hydril working pressure.

Step 3. Close uppermost pipe rams and open Hydril. Increase pressure to full working pressure of BOP. (Repeat test if stack has a second set of pipe rams.)

Step 4. Close manifold valve inside of choke and open choke. Re-pressure entire system to full working pressure.

Step 5. Close HCR valve, open manifold valve, and bleed pressure off manifold and lines. Re-pressure and test HCR valve.

Step 6. Close inside valve between stack and HCR valve. Open HCR valve. Pressure test inside valve. (If double valves are on any line, test each valve separately.)

Step 7. Test valve and check valve on kill line.

Step 8. Test valves on auxiliary choke line. Pull test plug.

Step 9. Pick up kelly with kelly cock in closed position. Test both upper and lower kelly cocks from underside.

Step 10. Open kelly cocks and close stand pipe valve. Test swivel, hose, and standpipe from underside.

Step 11. ONLY if casing shoe has not been drilled out. With nothing in the BOP, close the blind rams and pressure test below blinds to the lesser of either.

a. 80% of casing burst rating or

b. rated working pressure of BOP.

B. Kick Control and Blowout Prevention - Since the problem of blowouts and well kicks continues to be the most expensive problem one finds in drilling oil and gas wells, it is of great concern to EOC. For this reason, EOC requires that all drilling supervisors be familiar with EOC's preferred methods in killing a well kick.

1. EOC will use one of the following two methods in most killing operations.

   a. Driller's Method

      1. Circulate the kick with existing weight mud.

      2. Build kill weight mud.

      3. Circulate well with kill weight mud.

      4. Advantages:

         Easiest to perform.

         Allows time for building kill weight mud.

      5. Disadvantages:

         Results in highest surface pressures.

         Results in highest equivalent mud weight at casing seat.

         Requires several circulations.

   b. Wait and Weight Method

      1. Leave well shut in while building mud weight.

      2. Circulate well with kill weight mud.

      3. Advantages:

         Lowest surface pressures, and especially desirable with gas kicks.

         Removes kick and kills well in one circulation.

         Probably fastest overall method if not too long acquiring kill weight mud.

      4. Disadvantage:

         Most rigs don't have rig capacity to build a complete displacement volume at kill weight.

2. Suggestions for the Use of Pit Level Recording Instruments

a. Know total capacity of active mud system.

1. Indicator

a. Know how to use reference pointer. Always set reference pointer before making trip or circulating drilling break. Know what amount of mud is required to displace drill pipe and make sure this amount is indicated.

b. Indicator should be in front of driller, eye-level, and within arm's reach.

c. Know that recorder and indicator are recording and indicating same volume of mud.

d. Any changes in pit level or pen movement on indicator that occur, make sure same change occurs on recorder and make penciled notation on chart as to what the change represents, such as jetting pits, starting or stopping degasser, connection, etc.

2. Recorder

a. Know what each chart division represents.

b. Know how to set alarm. When coming on tour, make sure alarm is turned on and check to determine that the alarm span is close to present pit volume.

c. Determine what has caused any pit level change and note on the chart what has caused the change.

3. Transmitter

a. Make sure that no obstruction has been placed over floats that would prevent full travel (1-arm transmitter)

b. Keep floats on upright transmitters clean. Clean mud off of float and rings on the side of the float each tour. Check float movement by raising and lowering float each tour and always before making a trip. After moving floats, make sure an indication is noted on chart and indicator.

3. Suggestions for the Use of Flow Measuring Devices

a. Understand Flow Measuring Instruments and Their Components

1. Indicator

a. Know the circulating rate of the mud pump(s).

b. Understand the alarm settings.

c. Understand how to operate the pump stroke counter. Know how many pump strokes and the amount of mud to displace drill pipe.

d. Any changes in flow rate or pen movement on indicator that occur, make sure the same change occurs on recorder and make penciled notations on chart as to what the change represents.

2. Recorder

   a. Know what each chart division represents.

   b. Know how to set alarm. When coming on tour, make sure alarm is turned on and check to determine that the alarm span is close to present circulating rate.

3. Transmitters

   a. Make sure that no obstructions have lodged in the transmitter or under the "flapper".

   b. Make sure that all lines are connected to the transmitter.

   c. Understand any calibration procedures recommended by supplier.

Drilling foremen are to hold pit drills at least once weekly to train personnel to man their stations and do their jobs. This routine must be repeated until the crews can properly shut a well in with no more than a 10-barrel pit gain. Once the crews know what to do properly, repeat the drill for each crew once weekly. At least once each tour the mud pump should be slowed to half speed and the stand pipe pressure recorded as well as the SPM. This will be the low stroke drill pipe pressure used to circulate out a kick. CAUTION: Do not allow speed to overrule shutting the well in properly.

4. Shut-in Procedure

The following procedure for shutting in a kicking well can and will be used on all EOC wells. When a kick is detected, well is flowing, and pits are gaining mud, the following step-by-step procedure will be followed:

Step 1. Shut down mud pumps.

Step 2. Pick Kelly up out of rotary bushing.

Step 3. Open HCR valve and kill choke all the way open.

Step 4. Close Hydril (Later adjust pressure so that the well is under control but the drill pipe can be reciprocated with only a slight leak around drill pipe for lubrication.)

Step 5. Slowly close kill choke.

Step 6. Record:

a. Shut in drill pipe pressure

b. Shut in casing pressure

c. Pit volume gain

Step 7. If time permits, contact EOC's Houston office.

Step 8. Carefully select and plan the method of killing the well.

Step 9. Once the kill is started, the drilling supervisor is not to leave the choke controls.

5. Killing a Kicking Well

a. Immediately after a kick is detected and the well has been properly closed in, the following information should be known:

1. Depth of well (true vertical depth)
2. Mud weight when well kicked
3. Volume gained from kick
4. Shut-in casing pressure

b. Prior to the well kicking, the following should always be known and written down:

1. Casing data, especially the latest shoe test and 80% of maximum burst pressure.
2. Drill pipe data, size and capacity
3. Drill collars, size and capacity
4. Pump capacity, bbls/stroke, or strokes/bbl
5. Hole annular capacity around drill pipe
6. Low stroke constant circulating pressure (usually at 1/2 of drilling SPM)

Recording the above six pieces of information prior to a kick is considered a must by EOC.

With the preceding information, one can then carefully fill out the well kill work sheets and have the well kill planned properly.

8.6 Logging Program

The only log planned for this well is a gamma ray cement bond log with casing collar locator. The log will be run on a scale of 5" per 100' from 16,800' to 13,000'.

8.7 Christmas Tree Design

Figure 8-10 is a line drawing of the proposed christmas tree. The 7" casing will be packed off in the lower part of the spool and the tubing will be packed off in the upper part. All upper valves will be 2-1/16" I.D., 10,000 psi W.P. with high temperature sealing elements and H_2S trim. The 7" O.D. production casing will be landed in the upper section of the 9-5/8" casing head spool. The intermediate 9-5/8" casing head spool and the 13-3/8" surface casing head are of conventional design. Dual expansion - loop flow line wings will be mounted on the tree for simultaneous flow to balance forces imposed on the upper portion of the tree and to reduced friction loss. The lower ends of the flow loops tie together at the flow manifold as described in Section 11.

8.8 Friction Losses in Annulus

Figure 8-11 shows the estimated down hole friction losses versus production rates for the test well. Friction losses for annular flow are relatively low and should not significantly affect the flow capacity of the well in the 10,000 to 15,000 barrels of water per day range.

CHRISTMAS TREE SCHEMATIC

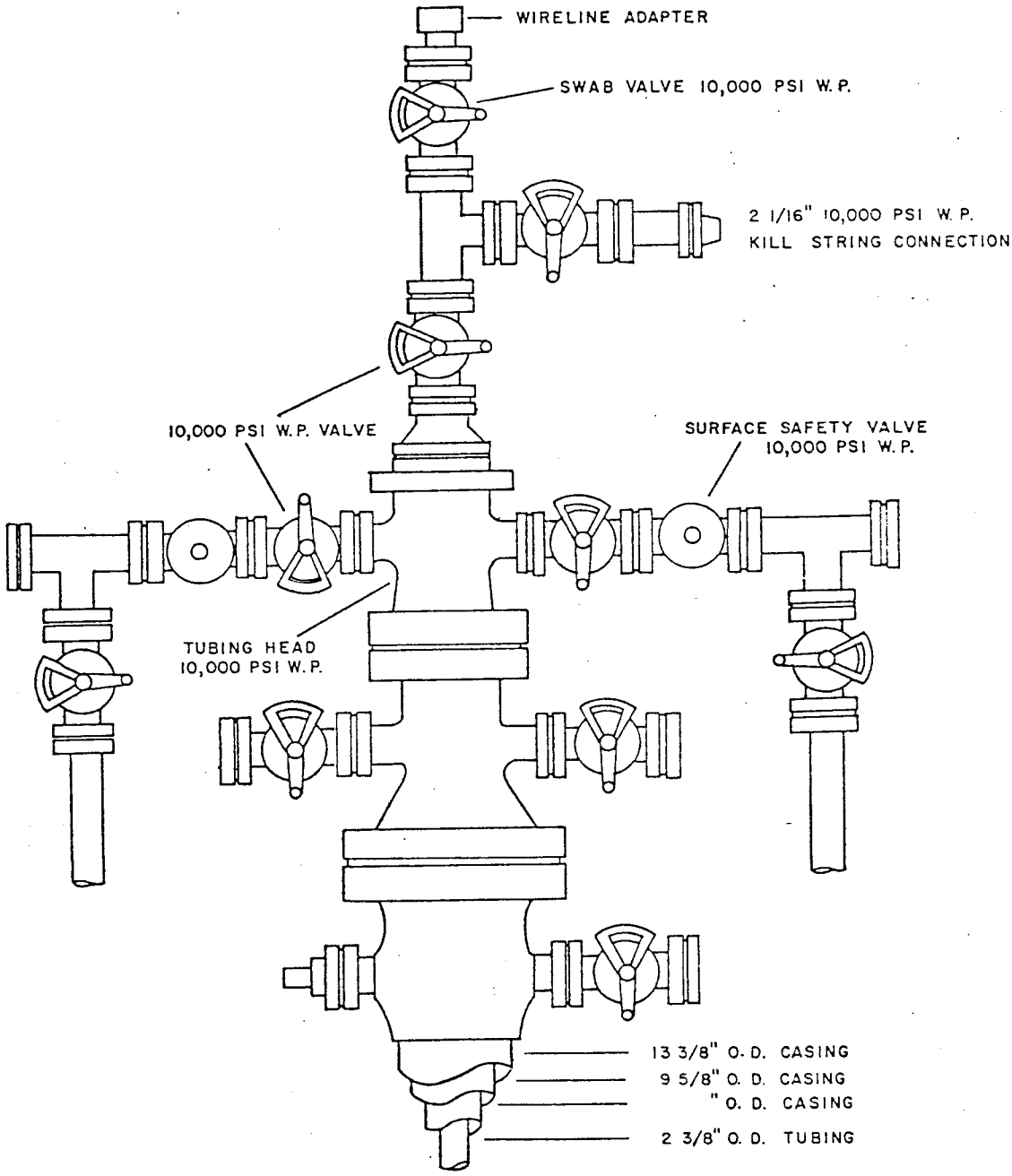

FIGURE 8-10

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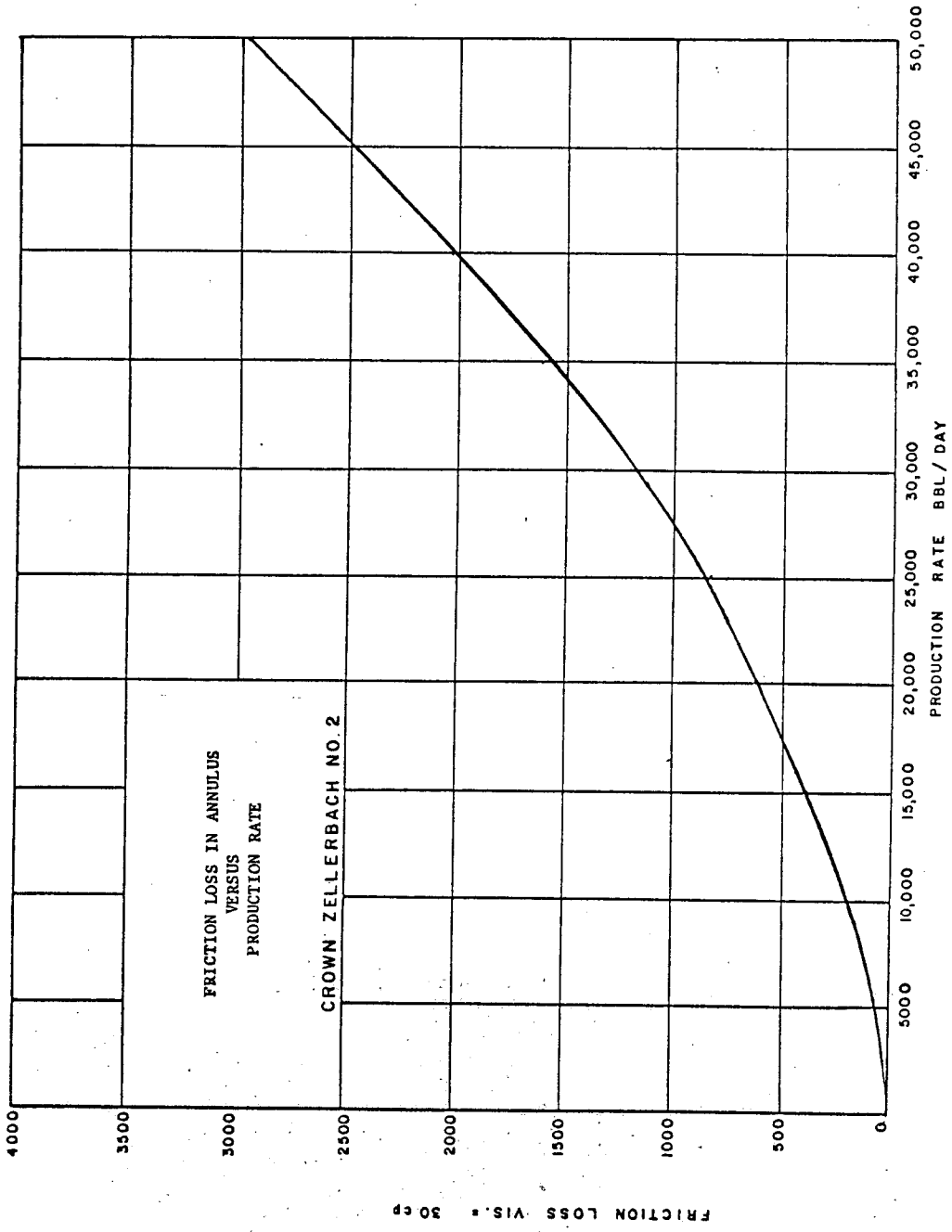

FIGURE 8-11

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8.9 Bit Program

The general bit program for drilling existing cement plugs, bridge plugs and cement retainers within the casing strings is as follows:

Casing Size O.D.	Minimum Drift Diameter	Type Bit
9-5/8" Casing	8.500"	Cement Bit

8.10 Peforating

Perforating the test zone will be accomplished with a 1-11/16 inch hollow carrier gun with four shots per foot. This gun will provide good penetration through a 7 inch production string and cement sheath along with good hole size. The test interval will be from 16,718 feet to 16,754 feet. Perforating will be performed with the 9.0 ppg salt water in the well and damage to the perforated interval should be slight.

8.11 Re-Entry and Completion Procedure

The completion prognosis for the test well follows and the estimated costs for the operations are included in Table 8-2.

Day No.	Procedure
1	Complete moving in rig and rigging up equipment. Dig out cellar and remove steel plate from casing stub.
2	Install and test 3,000 psi working pressure casing head on 13-3/8 inch casing. Start installing blowout preventers.
3	Finish installing blowout preventers and test rams to 3,000 psi and hydril to 2,100 psi.
4	Mix 300 barrels working volume of 10.0 ppg drilling fluid composed of water, gel, caustic, soda ash, and lignosulfonate. Pick up 8-1/2 inch bit and drill out cement plug at surface.
5	Make up casing patch, latch on to 9-5/8 inch casing and set casing slips in 13-3/8 inch casing.
6	Remove blowout preventers and install 5,000 psi working pressure casing head on 9-5/8 inch casing.
7	Install BOP's and test rams to 5,000 psi and hydril to 3,500 psi.
8	Pick up drill collars and go in hole with 8-1/2 inch cement mill to top cement plug at 3,400 feet ±. Circulate and condition mud and drill out cement plug and EZSV retainer.
9	Pull out of hole, install new cement mill and start going in hole.

Day No.	Procedure
10	Finish going in hole to top of cement plug at about 14,000'. Circulate and condition mud.
11	Pull out of hole and run casing inspection log. From 14,000 feet to surface.
12	Go in hole to 14,000 feet and displace 10.0 ppg water based mud with 13.8 ppg oil based mud.
13	Drill out cement plug and EZXV cement retainer and pull out of hole with cement mill.
14	Go in hole with 8-1/2 inch bit and start washing out open hole.
15-20	Finish washing out open hole to 17,000 feet.
21	Rig up lay down machine and extra work crew and pull out of hole laying down drill pipe. It is important that this operation be performed as quickly as possible.
22	Rig up casing torque turn crew and run 9000 feet of 7 inch 32#/ft. P-110 SFJ followed by 8000 feet of 7" 32# ft./L-80 Mod. Casing. Install downjet float shoe on bottom followed by two joints of casing and then conventional float collar. Install centralizers on each joint from bottom to 15,000 feet and one

Day No.	Procedure
22 (Cont'd)	every third joint from 15,000 feet to 13,000 feet (total of 60). Install cable type wipers spaced 20 feet apart, 50 feet below, across and 50 feet above zones to be tested.
23	Cement casing with enough cement to bring top of cement to 12,000 feet. Reciprocate pipe while cementing.
24	Wait a full 24 hours for cement to set.
25	Pull additional tension on casing until weight on block is 450,000 lbs. Set 7 inch casing slips with 450,000 lbs.
26	Install tubing head on 7 inch casing. Install 5,000 psi working pressure blowout preventers and test them according to Eaton procedures. Run gamma-ray cement bond log from bottom to top of cement.
27	Go in hole to bottom with 2-3/8 inch tubing. Displace 13.8 ppg mud with 9.0 ppg saltwater. Install wireline guide on tubing. Pull tubing up to 100 feet above proposed top of perforations. Install christmas tree.
28	Pressure test casing and christmas tree to 6,000 psi. Rig down equipment and begin to move out rig.

After rig has been moved out, perforate well from 16,718 to 16,754 feet with 1-11/16 inch hollow carrier gun, 8 holes per foot. Pressure casing up to 4,000 psi prior to first perforating job.

TABLE 8-2

ESTIMATED COST TO RE-ENTER

AND COMPLETE TEST WELL

MARTIN CROWN ZELLERBACH WELL NO. 2

Accounting Item	Item	Original Estimate
02	Field Labor	$ 44,000
09	Site	100,000
10	Drilling	275,000
11	Tangibles	725,000
12	Expendables	280,000
13	Cementing	77,000
14	Perf., Acid	88,000
15	Equip. Rental	113,000
16	Contract Serv.	87,000
17	Freight & Trans.	42,000
18	Other	11,000
19	Insurance	33,000
20	Consultants	-0-
21	Land Use	90,000
24	Testing	-0-
	TOTAL	$1,965,000

9.0 RE-ENTRY AND COMPLETION PROCEDURE FOR DISPOSAL WELL

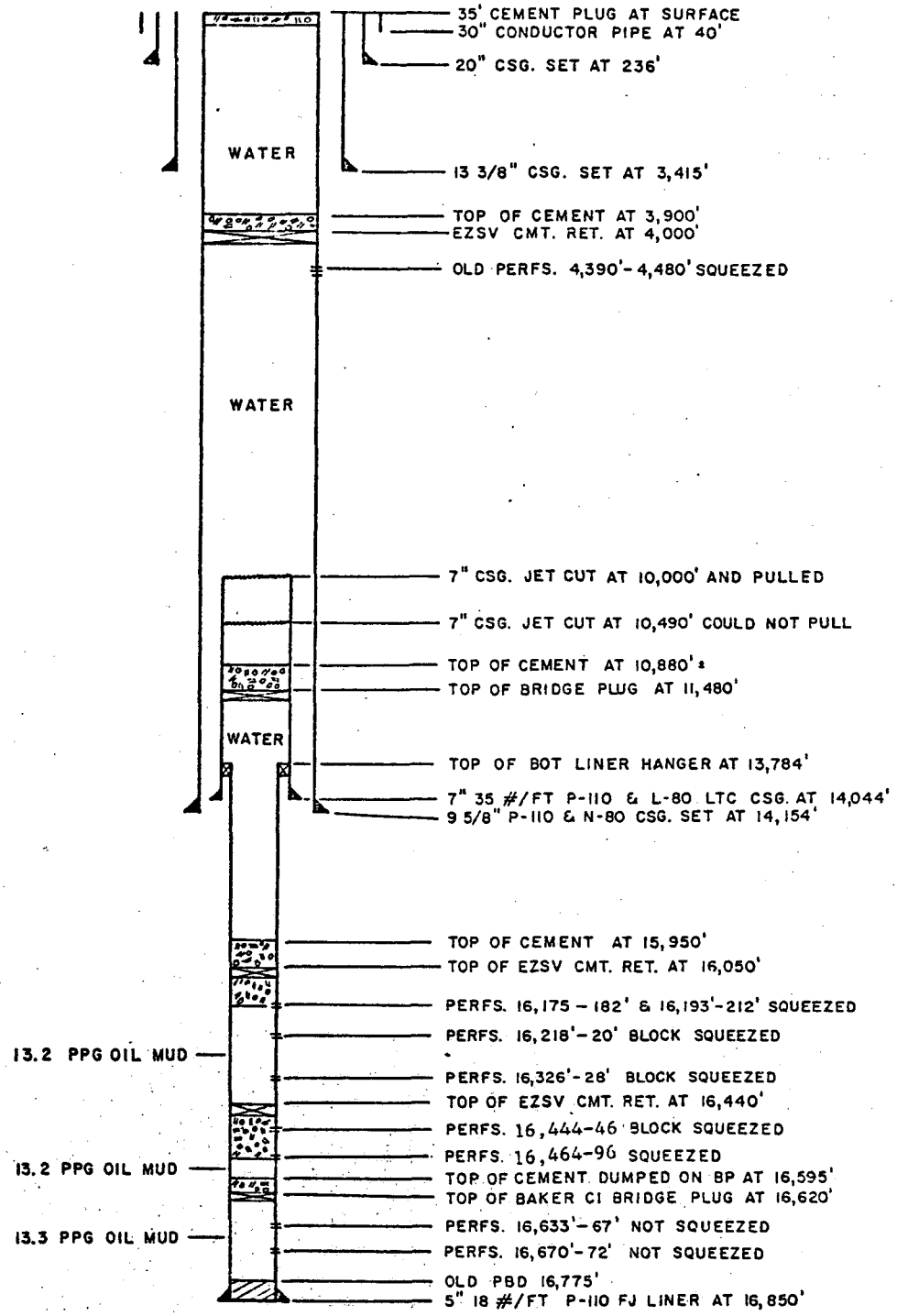
Brine disposal requirements are anticipated to be approximately 10,000 to 15,000 BWPD. The Crown Zellerbach Well No. 1 will be converted to a disposal well.

Figure 9-1 is a schematic diagram of the Crown Zellerbach Well No. 1 in its present condition. The well was abandoned leaving the intermediate casing head intact. The pipe was not cut at the surface.

The re-entry and completion procedure follows and the estimated costs for the operations are included in Table 9-1.

Day No.	Procedure
1	Complete moving in rig and installing equipment. Dig out cellar and remove steel plate from casing head flange.
2	Inspect condition of casing head flange. Install and test 3,000 or 5,000 psi working pressure blowout preventer stack and choke manifold and test same according to EOC procedure.
3	Prepare about 200 barrels working volume of 9.5 ppg salt water and gel. Pick up 8-1/2" cement mill and drill out 35' cement plug at surface. Pick up drill collars and go in hole with 8-1/2" mill to top of cement plug at 3,900'.

MARTIN CROWN ZELLERBACH WELL NO. 1



PRESENT CONDITION

FIGURE 9-1

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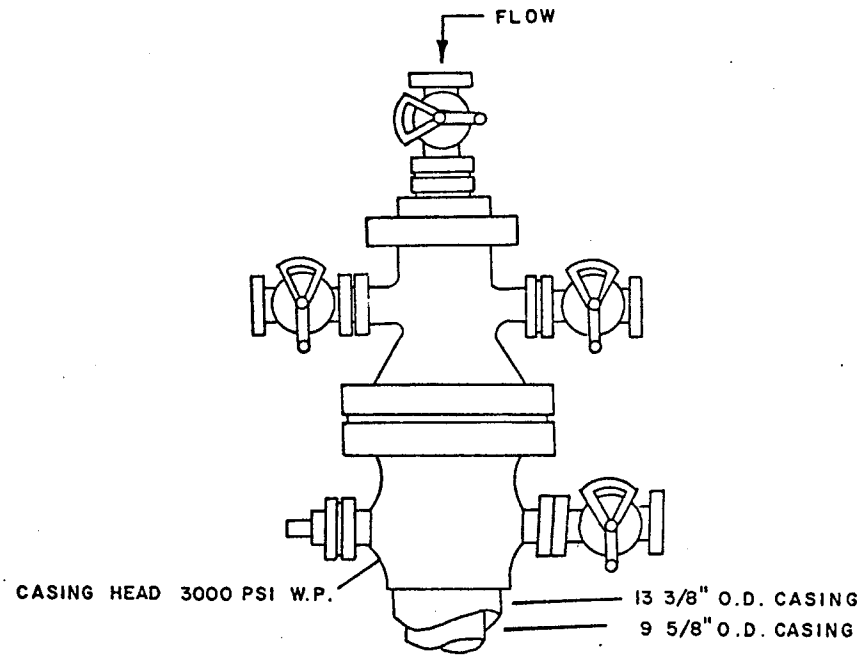
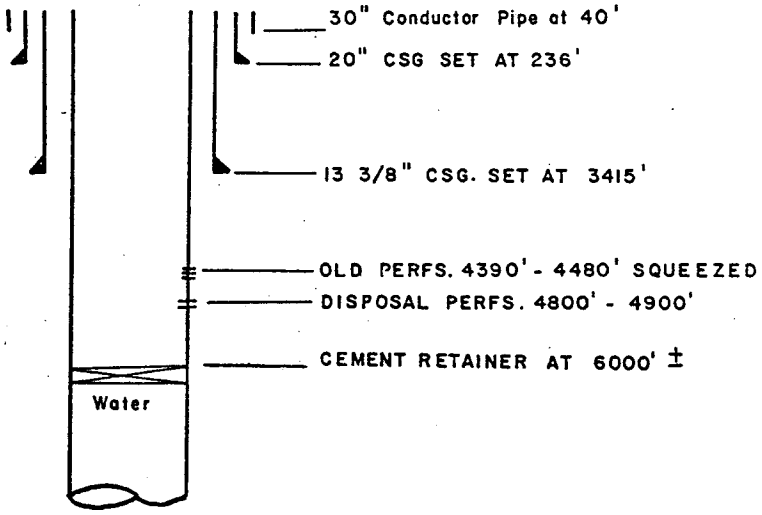
Day No.	Procedure
4	Drill cement from 3,900' to 4,000' and drill up cement retainer at 4,000'.
5	Go in hole to 6,000' and circulate clean 9.5 ppg salt water. Pull out of hole with cement mill.
6	Go in hole with cement retainer on work string and set same at 6,000± in 9-5/8" casing. Pressure test casing and old perforations from 4,390 to 4,480' by closing bag blowout preventer and placing 1,000 psi pressure on the 9-5/8" casing.
7	Pull out of hole and lay down work string on pipe racks.
8	Install disposal well christmas tree and begin moving out rig.
	After rig moves off location, rig up wireline unit and run gamma ray - casing collar locator log from 5,400' to 3,500'. Perforate well using 3-1/8" casing gun from 4800 to 4,900', four holes per foot. Perform injectivity tests and acidize if necessary. For acid, use 5,000 gal. of FE acid with 250 gal. of OWG diverter followed by 10,000 gal. of regular HF acid.

Figure 9-2 is a schematic drawing of the proposed disposal well completion.



SURFACE WELL HEAD

DOWNHOLE WELL SETTING



CROWN ZELLERBACH WELL NO. 1
PROPOSED DISPOSAL WELL COMPLETION

Figure 9-2

DOE CONTRACT NO.
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TABLE 9-1

ESTIMATED COST TO RE-ENTER

AND COMPLETE DISPOSAL WELL

MARTIN CROWN ZELLERBACH WELL NO. 1

Accounting Code	Item	Original Estimate
02	Field Labor	$ 13,000
09	Site	22,000
10	Drilling	80,000
11	Tangible	6,000
12	Expendables	30,000
13	Cementing	-0-
14	Perf., Acid	45,000
15	Equip. Rental	9,000
16	Contract Serv.	11,000
17	Freight & Trans.	11,000
18	Other	11,000
19	Insurance	-0-
20	Consultants	-0-
21	Land Use	85,000
24	Testing	-0-
	TOTAL	$323,000

10.0 SURFACE PRODUCTION AND TEST FACILITIES

The surface test facilities are designed to produce and inject the well effluent continuously and to obtain the data as described in Section 11.0 of this book. The design incorporates the necessary safety, corrosion, and environmental protection features. Design criteria are:

- Wellhead Working Pressure 10,000 PSI
- Flow Line Shut-In Pressure 6,000 PSI
- Temperature 350°F
- Well Effluent 15,000 BWPD
- Natural Gas Content Unlimited
- H_2S 50 PPM
- CO_2 22%

The pressure relief and bypass lines will discharge either to the reserve pit or to steel holding tanks. A pilot-operated gas flare will be located a safe distance from the wells and facilities. The piping, valves and vessels will be designed in accordance with applicable codes, standards and regulations.

10.1 Main Process Equipment

Figure 10-1 is a schematic diagram of the surface test equipment. The well stream will enter the flow line at a point where the two flow loops connect. The flow rate, pressure, and temperature will be measured before the well stream enters the choke manifold. Fluid samples can be obtained ahead of the choke manifold and before the primary chemical inhibitor injection point.

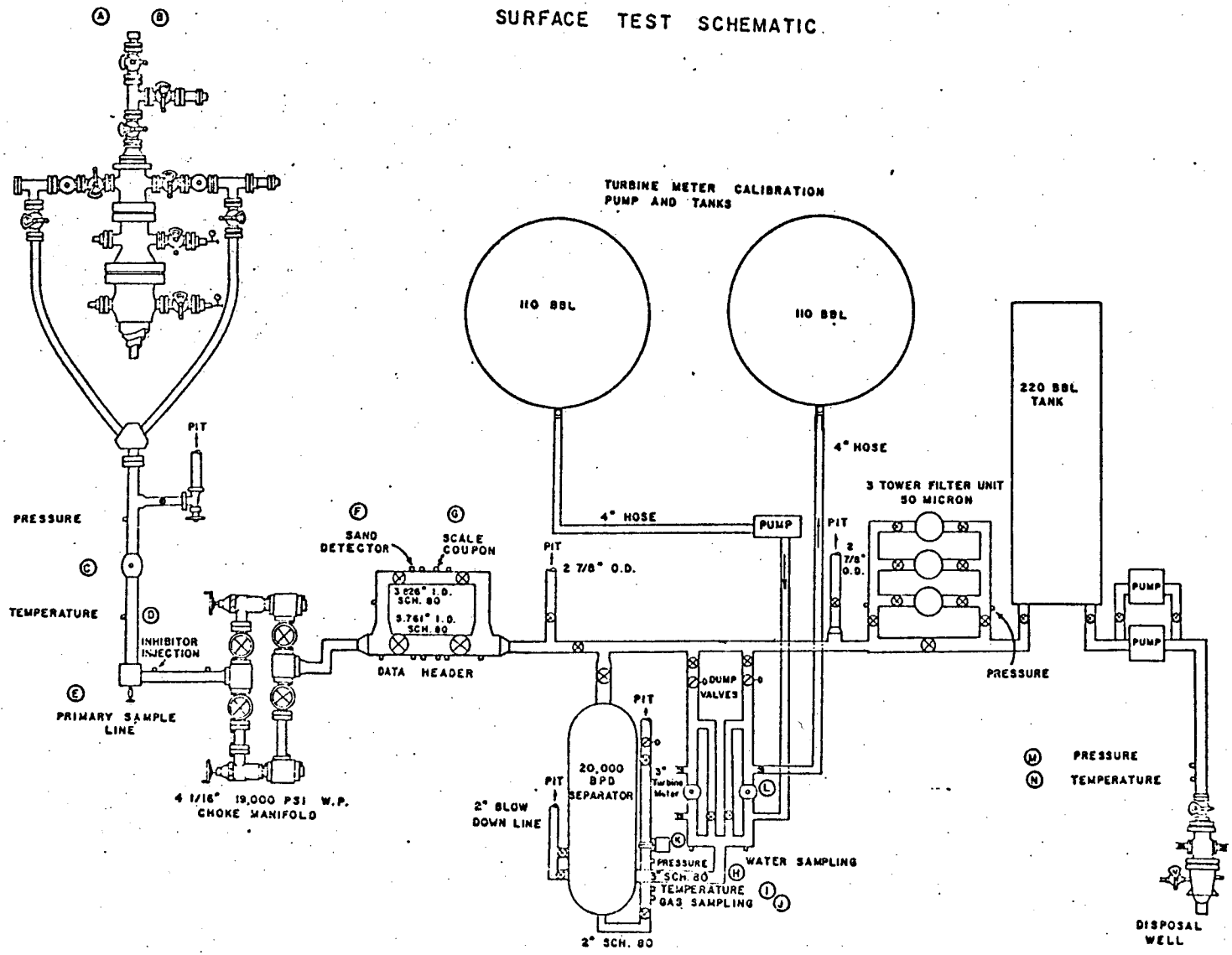

FIGURE 10-1

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The separator will be a conventional well test separator. The gas will be flared. The brine will pass through a flow meter manifold and a filtering system before entering the disposal well.

The separator, filters and chemical pumps will be taken from D.O. E. stock for an estimated reduction in rental cost of $69,500 for the anticipated 21 day test period. This equipment will also be utilized on future tests in lieu of rental equipment to obtain additional cost reductions.

10.2 Safety Considerations

The test well christmas tree will be equipped with two fail safe closing pneumatic safety gate valves. The safety valves will close should pressures in the production system reach pre-set values. The pneumatic system can also be manually activated at a safe distance from the test well. An active mud system will be installed on location so that mud can be pumped down the tubing string to kill the well if necessary.

All test equipment will be pressure tested prior to flow. There will be several relief and by-pass lines to the pit. Caution signs will be posted to warn visitors of the high pressure, high temperature pipes and vessels. Personnel will be required to wear hard hats.

A detailed H_2S safety program and emergency evaluation plan are shown in Exhibit "A".

10.3 Sand Considerations

Sand production could cause erosion in the wellhead, process lines, chokes, control valves, and partial plugging of other equipment. A sand detector probe will be installed to monitor sand production and the well stream will be diverted to the pit if sand production is significant.

10.4 Corrosion and Scaling

The well stream is expected to be of low salinity and scaling should not be a major problem. A scale inhibitor can be placed into the flow system at the bottom of the tubing and/or upstream of the choke manifold.

Corrosion from hydrogen sulfide may become a problem during testing. Carbonic acid (from CO_2) might also cause corrosion. Water-soluble corrosion inhibitors will be placed into the flow stream at the bottom of the tubing and/or up stream of the choke manifold.

10.5 Contingency Plan

The contigency plan for the test equipment is shown in Figure 10-2 followed by a narrative of the plan.

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FAULT TREE ANALYSIS
OF START UP OF PRODUCTION TEST EQUIPMENT

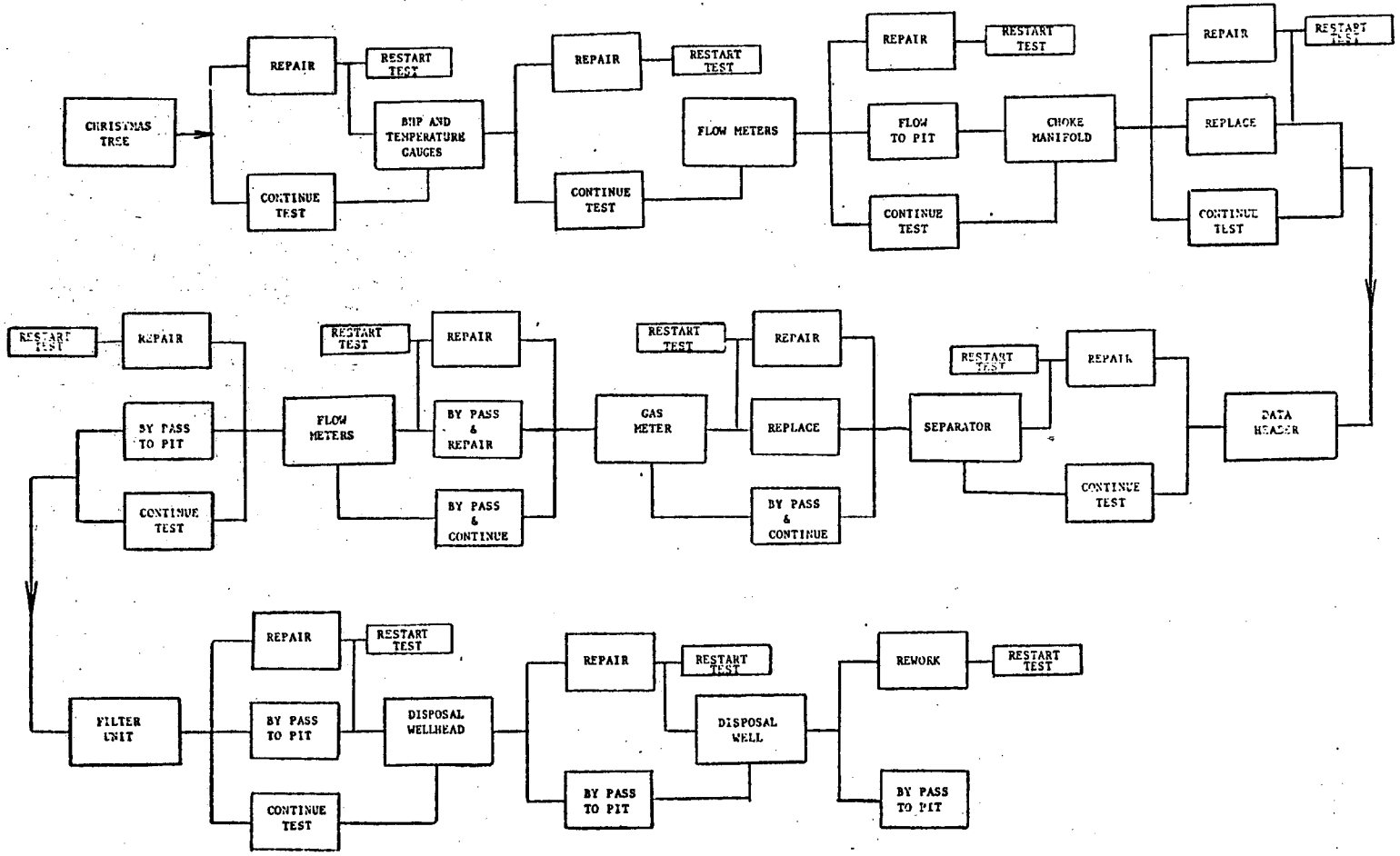

FIGURE 10-2

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CONTINGENCY PLAN

The solutions to possible failures or problems listed below depend on the particular phase of each portion of the test at the time the problem occurs.

Critical Test Equipment

Problem	Solution
1. Christmas Tree	A. Flow through opposite side until repairs made.
	B. Shut-in well, make repairs, restart test.
2. Flow Meter	A. Continue test and rely on other two flow meters.
	B. Flow to pit and repair.
	C. Shut-in well, make repairs, restart test, or continue test.
3. Choke Manifold	A. Continue test through alternate loop.
	B. Repair and switch flow back from alternate loop.
	C. Shut-in well, make repairs, restart test or continue test.
4. Data Header	A. Continue test through alternate loop.
	B. Shut-in well, repair, restart or continue test.
5. Separator	A. By-pass separator to filter or pit and continue test, can measure all fluids except gas volume.
	B. Shut-in or by-pass separator to pit or filter, repair, continue or restart test.
	C. Replace separator and continue or restart test.

Problem	Solution
6. Gas Meter	A. By-pass and repair.
	B. By-pass and continue test.
	C. Shut-in, repair and restart or continue test.
7. Flow Meters (Calibration Manifold)	A. Continue test through alternate meter while repairing.
	B. Shut-in well, repair and restart or continue test.
	C. By-pass to pit and continue test.
8. Filter Unit	A. Continue test through alternate loop.
	B. Shut-in well, repair and restart or continue test.
	C. By-pass to pit and continue test.
9. Salt Water Disposal Wellhead	A. Shut-in well, repair and restart or continue test.
	B. By-pass to pit and continue test.
10. Salt Water Disposal Well	A. Shut-in test well, perform remedial work on disposal well, restart or continue test.
	B. By-pass to pit and continue test.
11. Subsurface Bottom Hole Pressure and Temperature Gauges	A. Shut-in well, replace and restart test.
	B. Continue test.

NON-CRITICAL TEST EQUIPMENT

The following list covers non-critical test equipment the loss of which should not cause shut-down of the test. These items could be repaired/ replaced during actual testing or during a scheduled shut-in period. The complete loss for an extended time or through a particular phase of the test should not adversely affect the overall test.

1. Dead Weight Tester at Wellhead of Test Well.
2. Primary Sample Line.
3. Primary Inhibitor Injection Point.
4. Sand Detector.
5. Surface Sample and Gauge Points.
6. Various Valves.
7. Calibration Tanks.
8. Calibration Pump.
9. Salt Water Disposal Well Pressure Recorder.

10.6 Typical Equipment

A cutaway drawing of a typical gate valve utilized on a christmas tree is shown in Figure 10-3. Surface safety system diagrams and equipment drawings are shown in Figure 10-4.

W-K-M POW-R-SEAL GATE VALVE

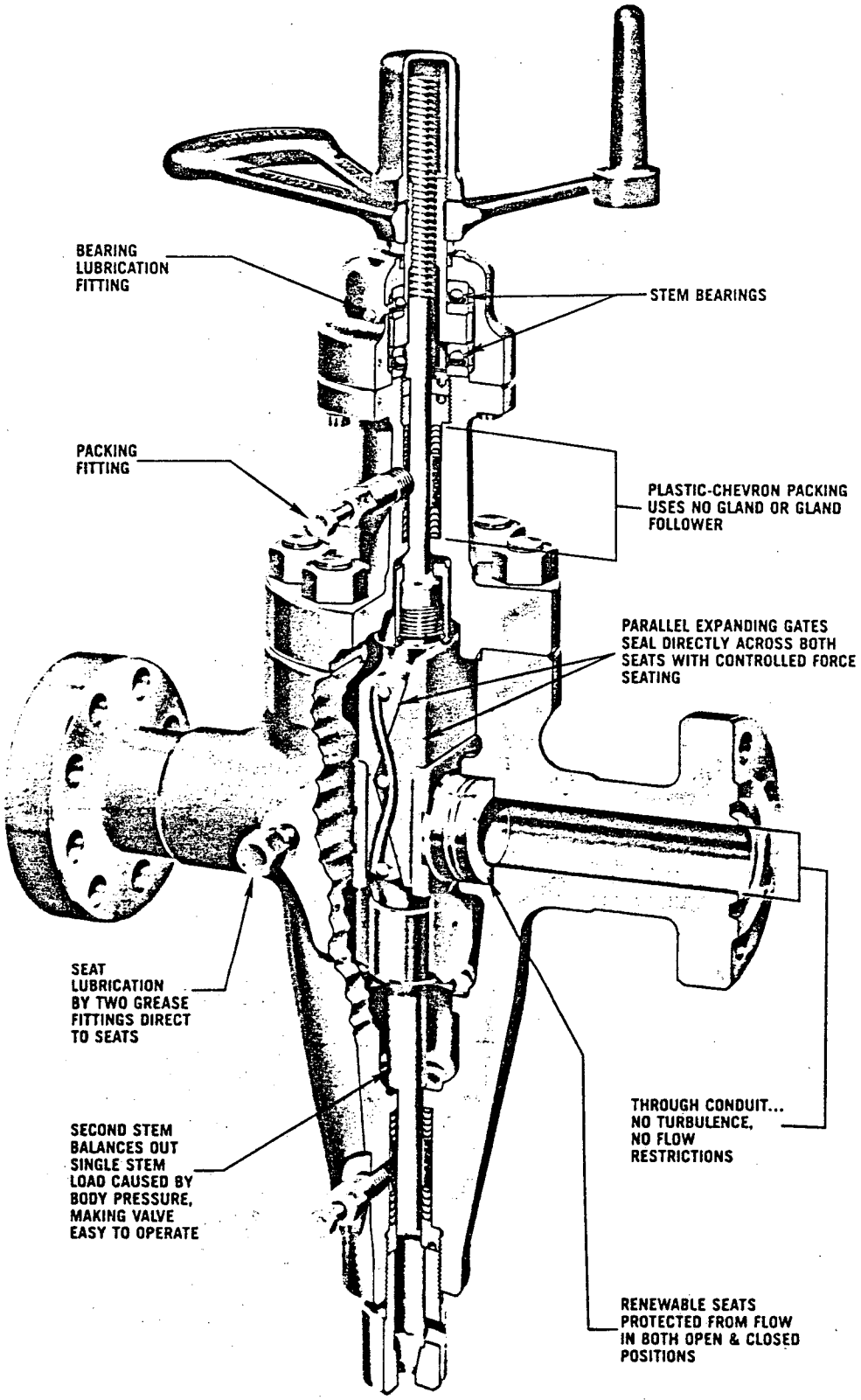

FIGURE 10-3

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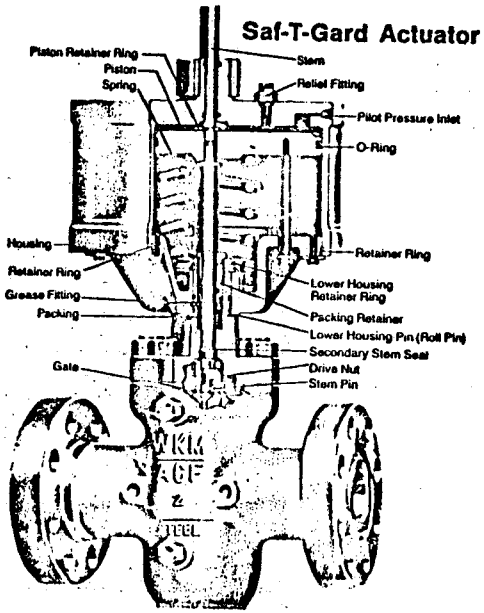
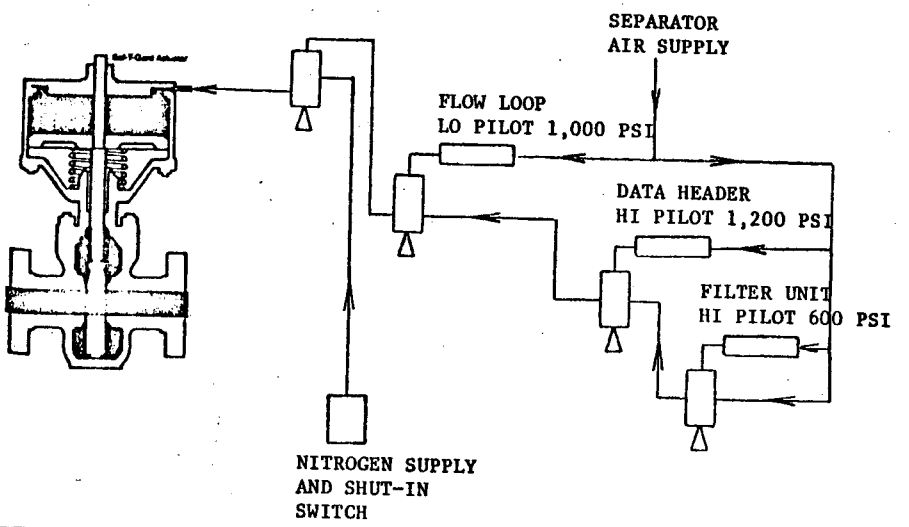
FIGURE 10-4

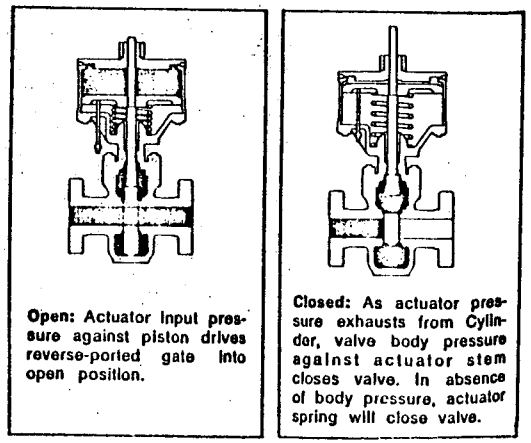
TYPICAL W-K-M SURFACE SAFETY SYSTEM

Saf-T-Gard Actuator



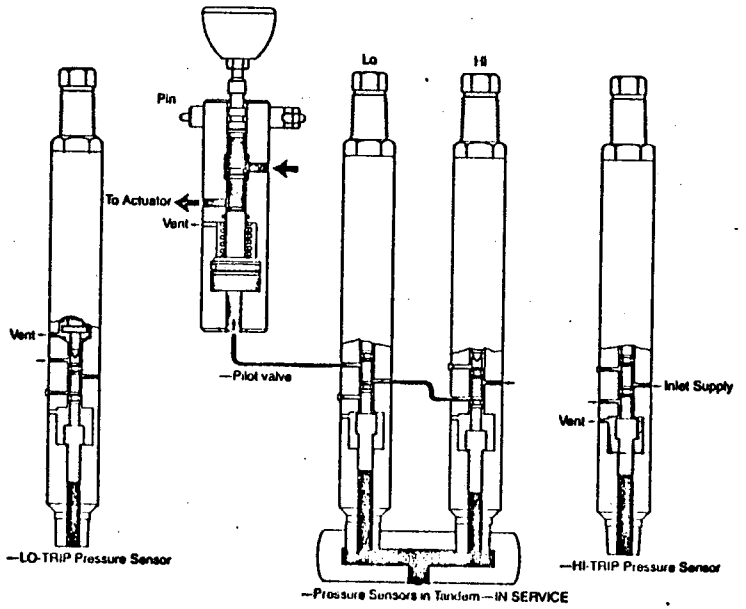


FAIL-SAFE CLOSED OPERATION



Open: Actuator input pressure against piston drives reverse-ported gate into open position.

Closed: As actuator pressure exhausts from Cylinder, valve body pressure against actuator stem closes valve. In absence of body pressure, actuator spring will close valve.



11.0 WELL TEST

11.1 Test Procedure

The test operation will commence when the surface test equipment is installed as shown in Figure 10-1 and made operational. Both the tubing and casing will be full of brine. The test will then proceed as outlined below if early interpretations so indicate as determined by the on-site reservoir engineer. Minor adjustments to the procedure may be deemed necessary, however.

A. Run Hewlett-Packard pressure and temperature transmitter to middle of perforations at approximately 16,736 feet. Obtain pressure and temperature measurement every 1000 feet while going in hole. After reaching depth, wait for pressure and temperature readings to stabilize and pull transmitter into tubing. Switch to pressure transmitter only in tubing at a depth of approximately 16,600 feet and commence production tests. Surface recording pressure and temperature gauges to be in operation continuously.

B. Open well at uniform rate over a 30 second period to a production rate of 2400 B/d. Separator will be bypassed, as necessary, until the sand detector indicates that the flow stream is free of sand and completion debris.

C. Commence flow through the separator and maintain constant production rate of 2400 B/d until radial flow in the reservoir has been definitely established as determined by analysis of the pressure decline data by the reservoir engineer on location.

D. Begin next flow test by opening choke over 30 second period to a constant flow rate of 5,000 B/d. Bypass separator when produced volume is near the annular volume and continue to bypass the separator until the sand detector indicates the flow stream to be free of sand or debris. Then resume flow through the separator. Flow the well at a constant rate of 5,000 B/d for approximately 5 days. Progress of the test will be closely monitored by the reservoir engineer conducting the test.

E. Open the choke over a 30 second period to flow rate of 10,000 B/d. Again bypass separator when bottoms come up until the sand detector indicates the flow stream to be free of sand and debris.

F. If well bore mechanics and reservoir are capable of producing at a constant rate above 10,000 B/d then open choke to the higher rate from the 10,000 B/d rate without shutting in the well. Once the flow has stabilized at this rate and radial flow has been established then flow at this constant rate for approximately 24 hours.

G. Shut in well from high flow by gradually closing the choke over a 30 second period. Continue to measure bottom hole pressure build-up for at least 24 hours.

H. Remove Hewlett-Packard gauge from well. If conditions warrant, make pressure and temperature measurements on even 1000 feet interval while coming out of the well. When the Hewlett-Packard gauge is at the wellhead, make a cross check with the wellhead pressure gauge.

RESERVOIR LIMIT TEST

RESERVOIR DRAWDOWN TEST

FOR

GEOTHERMAL-GEOPRESSURED WELL

Test Date:_____ Type Test:_____ Lease and Well No._____

Producing Formation:_____ Field:_____

Hole Size:_____ Casing Size:_____ Tubing Size:_____ State:_____

Cumulative Production:_____ Gas Gravity:_____, Z:_____

Constant Rate Production:_____(Bbls./Day) Water Salinity:_____PPM Total Solids

Total Production Life:_____Days Porosity, ϕ :_____Gas-Water Ratio_____Ft^3/Bbl.

Reservoir Temperature:_____^oF Net Pay:_____ft. Perfs:_____ft.

μ_g_____cps μ_w_____cps Bw_____R.B./B Bg_____R.B./MCF

C_T_____ $X10^{-6}$ C_g_____$X10^{-6}$ C_w_____$X10^{-6}$ C_r_____ $X10^{-6}$

m_____psi/cycle P at 1 hour _____Sg_____Sw_____Pi_____

Calculation of kh (md-ft) and k (md):

kh = 162.6(Q)(B)(μ)/(m)

kh = 162.6 ( ) ( ) ( )/( ) = _____md-ft

k = ( )md-ft/( ) ft = _____mds

$B_g = (Pb)(Tf)(Z)(1000)/(5.61)(520)(P_R)$ =

Bg = ( )( )( ) .34279/( ) = _____ Res. Bbl./MCF

Calculation of Skin effect, s; and Pressure Loss Due to Skin, ΔP skin

$$s = 1.151\left[\left(\frac{P_i - P_{1\,hr}}{m}\right) - \log\left(\frac{K}{\phi \mu C_t r_w^2}\right) + 3.23\right]$$

$$s = 1.151\left[\left(\frac{(\quad)-(\quad)}{(\quad)}\right) - \log\left(\frac{(\quad)}{(\quad)(\quad)(\quad)(\quad)(\quad)}\right) + 3.23\right] = \_\_\_\_\_$$

ΔP skin = (0.87)(s)(m) = psi

ΔP skin = (0.87)( )( ) = _____psi

Diffusivity, η

$\eta = .006328\ (k)/\phi\mu C_T$ =

η = .006328 ( )/( )( )( ) = _____ft^2/day

Calculation of Productivity Index (B/D-psi) and Completion Efficiency, CE

$$J\ (actual) = \frac{Q_w}{P_i - P_f} = \frac{(\quad)}{(\quad - \quad)} = \_\_\_\_\_ \text{Bbls./D-psi}$$

$$J\ (ideal) = \frac{Q_w}{(P_i - P_f) - \Delta P\ skin} = \frac{(\quad)}{(\quad - \quad) - (\quad)} = \_\_\_\_\_ \text{Bbls./D-psi}$$

$$CE = \frac{J\ (actual)}{J\ (ideal)} = \frac{(\quad)}{(\quad)} = \_\_\_\_\_ \quad OR \quad \_\_\_\_\_ \%$$

Distance to Barriers or Discontinuities, d $\quad d = 2\sqrt{t}$

$d = 2\sqrt{(\quad)}\ x\sqrt{t} = (\quad)\sqrt{t}$

t time, days	$\sqrt{t}$	d, ft.	m (psi/cycle)	Flow Angle	Jones Y Function	Bbls. of Aquifer Explored or tested

FIGURE 11-1

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3100 Edloe
Houston, Texas 77027
(713) 627-9764

DOE CONTRACT NO.
DE-AC08-80ET-27081

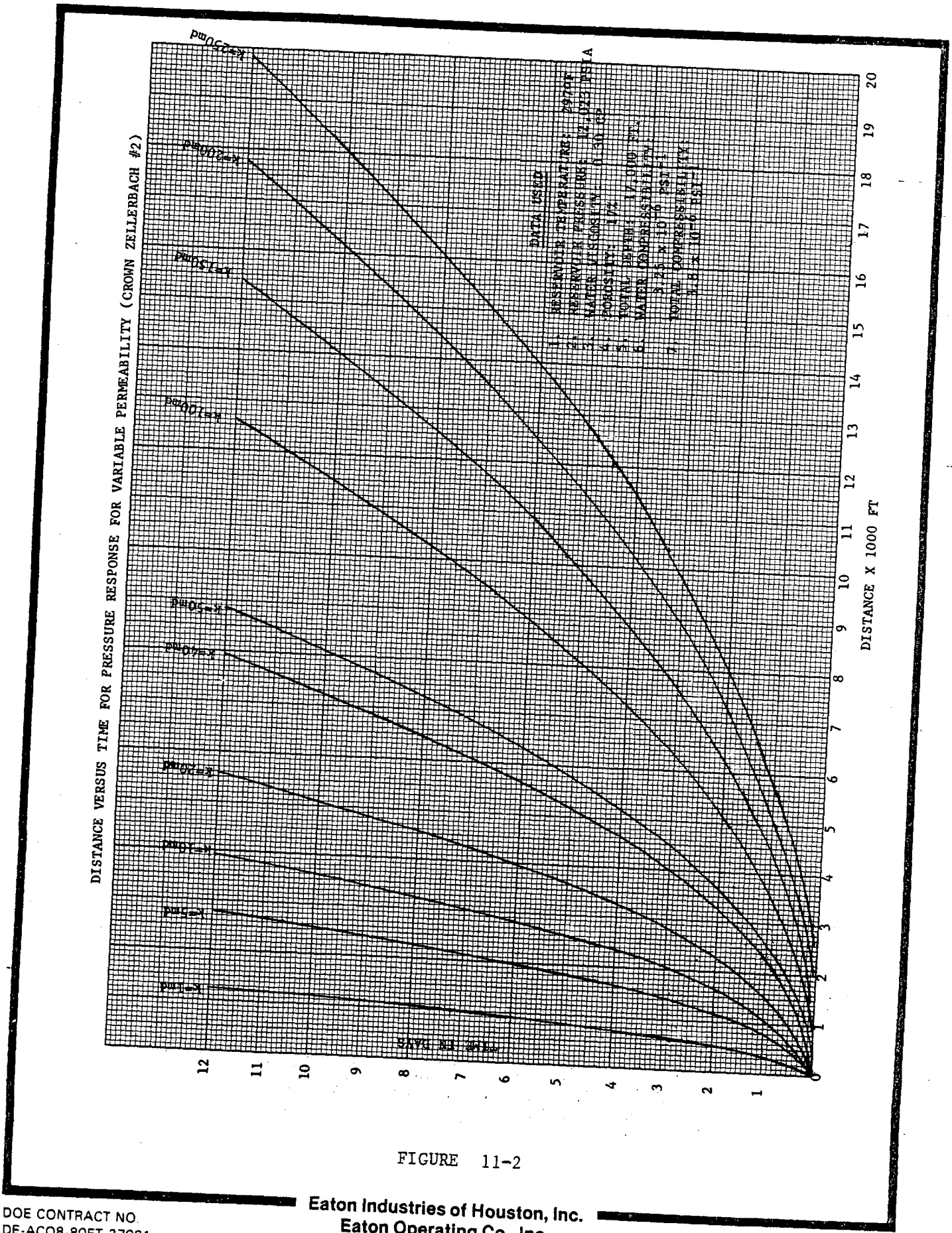


FIGURE 11-2

DOE CONTRACT NO.
DE-AC08-80ET-27081

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3104 Edloe, Suite 200
Houston, Texas 77027
(713) 627-9764

11.2 Test Analysis Methods

The basic test analysis to be conducted by the reservoir engineer on location will consist of plotting the bottomhole pressure as a function of the logarithm of time. On this type of plot, radial flow in the reservoir is indicated by a straight line plot on the graph. Different straight line segments and breaks in the slope and offsets are then interpretated by the reservoir engineer as to their significance. For data that follow usual flow rate reservoir mechanics, the permeability and reservoir limits can be evaluated by performing the calculations on the form showed in Figure 11-1. Should unusual or unexpected flow behavior be observed, then more detailed or different analysis may be necessary.

Figure 11-2 graphically shows the calculations for different assumptions of permeability. Some preliminary production calculations were made using a radial flow reservoir simulator. Figure 11-3 is a print out of one of the calculations. These calculations indicate that the well should be able to flow at 18,000 BWPD assuming good well completion efficiency and a permeability of at least 50 md.

MARTIN CROWN ZELLERBACH #2

Radial Flow Reservoir Simulator Calculations

WELLBORE RADIUS (FT)	0.300
EFFECTIVE RESERVOIR RADIUS (FT)	8150.0
INITIAL RESERVOIR PRESSURE (PSI)	12023.0
PERMEABILITY (DARCYS)	0.0500
POROSITY (FRACTION)	0.1700
RESERVOIR THICKNESS (FT)	39.0000
ROCK PV COMPRESSIBILITY (1/PSI)	3.0000E-006
FLUID COMPRESSIBILITY (1/PSI)	3.8000E-006
FLUID VISCOSITY (CP)	0.2500
FLUID DENSITY (LBS/CU FT)	60.3900
SKIN FACTOR (DIMENSIONLESS)	2.0000

PRODUCTION PIPE (TUBING) PARAMETERS

SECTION	LENGTH (FT)	DIAMETER (FT)	SURFACE FINISH
1	16600.00	0.~~41770~~ 5012	AVERAGE

INITIAL AMOUNT OF WATER IN PLACE	246894872 BBLS
TIME TO SEMI STEADY STATE IS	14.71 DAYS
HYDROSTATIC PRESSURE IS	6961.10 PSI
INITIAL WELL HEAD PRESSURE IS	5061.82 PSI
MAXIMUM ALLOWABLE FLOW RATE	20000.00BBLS/DAY
MINIMUM ALLOWABLE WELL HEAD PRESSURE	500.00 PSI
MINIMUM ALLOWABLE FLOW RATE	1000.00BBLS/DAY

TIME (DAYS)	FLOW (BBLS/DAY)	BOTTOM (PSI)	FRICTION (PSI)	WELL HEAD (PSI)	SKIN EFF. (PSI)	CUM (BBLS)
0.0	20000.00	12023.00	358.62	3041.65	861.55	0
1.0	20000.00	8914.06	358.62	732.71	861.55	20000
2.0	20000.00	8788.54	358.62	607.19	861.55	40000
3.0	20000.00	8715.12	358.62	533.77	861.55	60000
4.0	19920.12	8676.45	355.93	501.23	858.11	79920
5.0	19761.32	8663.20	350.61	500.14	851.27	99681
6.0	19623.40	8654.26	346.02	501.73	845.33	119305
7.0	19505.95	8647.19	342.13	503.62	840.27	138811
8.0	19408.62	8640.57	338.93	504.39	836.07	158219
9.0	19331.10	8633.47	336.38	503.17	832.73	177551
10.0	19253.89	8628.64	333.86	504.19	829.41	196804
11.0	19196.19	8622.25	331.98	502.17	826.92	216001
12.0	19138.66	8617.36	330.11	501.63	824.44	235139
13.0	19081.30	8613.74	328.25	502.34	821.97	254221
14.0	19024.11	8611.19	326.40	504.10	819.51	273245
14.7	19005.09	8606.11	325.79	500.46	818.69	286704
15.0	18910.25	8601.31	322.73	502.79	814.60	292222
16.0	18872.45	8596.03	321.52	500.33	812.98	311095
17.0	18815.89	8593.99	319.71	502.56	810.54	329910
18.0	18778.28	8588.74	318.51	500.13	808.92	348689
19.0	18722.00	8586.71	316.72	502.32	806.50	367411
20.0	18665.89	8584.69	314.93	504.51	804.08	386077

Figure 11-3

11.3 Data Acquisition

Data collection points are indicated on Figure 10-1 by circled letters and are listed below.

Data Point	Description
A.	Bottom Hole Pressure and Temperature (Hewlett Packard Quartz Crystal Pressure Gauge)
B.	Surface Pressure Gauges and Dead Weight Tester (Panex 0 - 5000 psi Gauge) (Gould 0 - 5000 psi Transmitter)
C.	Fluid Flow Meter (3" Camco Turbine Meter)
D.	Fluid Flowing Temperature (Foxborrough 0 - 400^{o}F Transmitter)
E.	Primary Fluid Sampling Line (1/4" NPT Threads)
F.	Fluid Sand Content Detector (OIC Sand Systems Sonic Sand Detector)
G.	Scale-Corrosion Coupon (Baroid Standard Coupon)

H. Separator Pressure

(Gould 0 - 2000 psi Transmitter)

I. Separator Temperature

(Foxborrough 0 - 400°F Transmitter)

J. Gas Sample Point

(1/4" NPT Threads)

K. Gas Orfice Meter ΔP

(Gould 0 - 400" H_2O Transmitter)

L. Fluid Flow Meters

(3" Halliburton Turbine Meters)

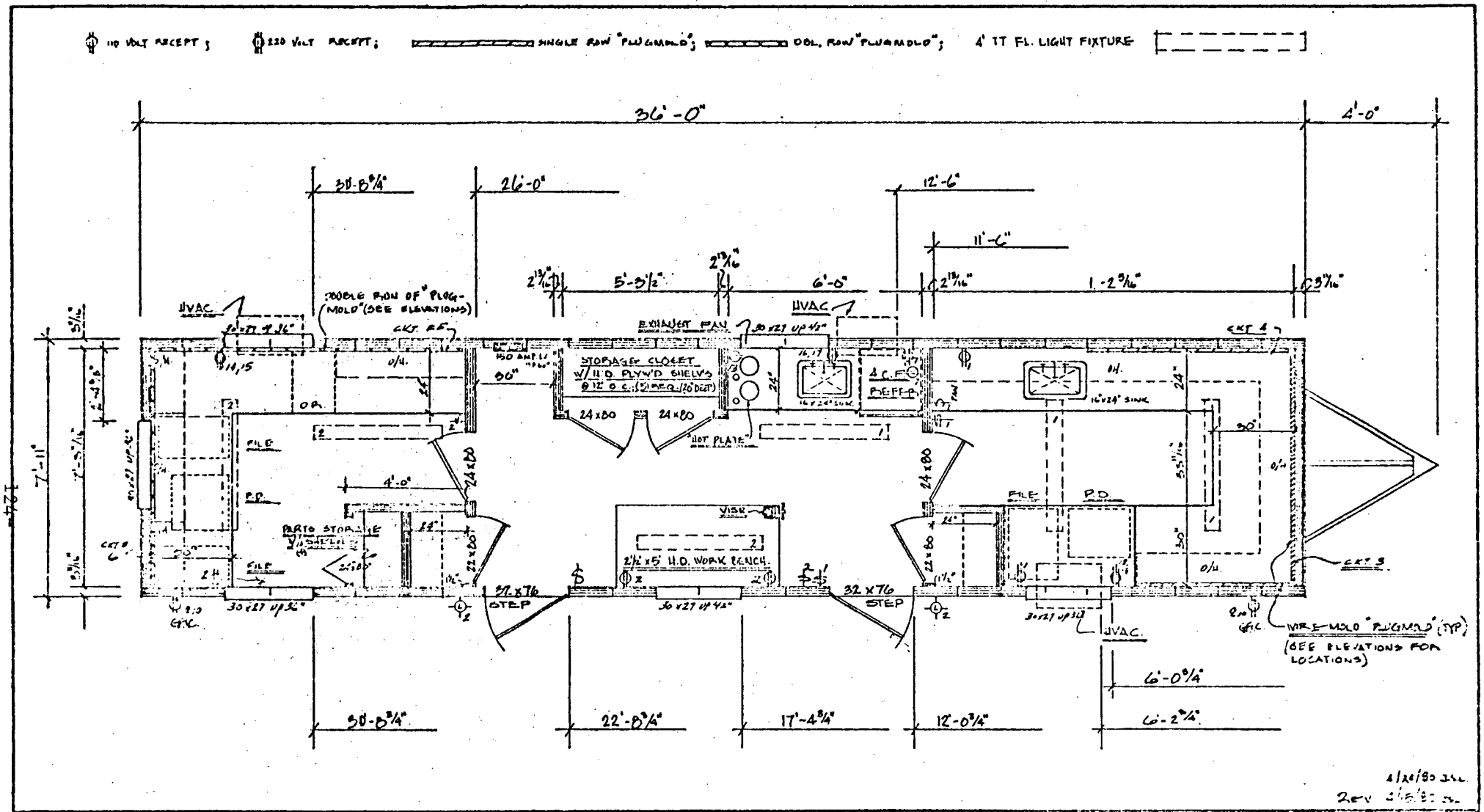
M. Disposal Well Injection Pressure

(Gould 0 - 5000 psi Transmitter)

N. Disposal Well Water Temperature

(Foxborrough 0 - 400°F Transmitter)

Figure 11-4 is a copy of the floor plan of the IGT mobile trailer. The front end contains the on-site chemical laboratory. The mid-section is a work area and the rear section is the electronic data gathering system. The



frame type 0° JA. I BEAM	sidewalls 2x4 @16" o.c., 8'-0, R-11 INSUL.	main sewer drop 1½" & WATER INLET (¾")	
hitch TAPER EXTENDED	paneling 5/32" LAUAN		
ctr. of axles 24'-8"	windows (6) 30x27	NOTE TO ELECTRICIAN: RUN (2) SETS OF "PLUGMOLD" IN REAR OFFICE - BOTTOM RUNS TO GO TO MAIN L.C. EXT #5&6 - RUN TOP SETS TO "J"-BOX (4"x4") BELOW L.C. AND 24" ABOVE FLOOR.	scale 3/8"=1'-0" | date 3/15/80 | drawn by J. LINDSEY
floor type 2x4 TRANSVERSE @16" O.C. / R-7	ext. doors (2) 32 x76		dealer/client AMERICAN MOBILE OFFICE
floor deck ⅝ PLYWOOD UNDERLAYMENT	ceiling ⅝ GYP.		
floor cover VINYL ROLL GOODS	electrical serv. 150 AMP 240/110 -VOLT		model F-8x40
floor registers NONE	air conditioning (2) 9600 BTU "G.E." W/HEAT	all datum dimensions are from front and left edge of floor.	quotation no. 2499-R production no. 1698
heat duct NONE	change lines NONE		
heat 2 HEAT A/C COMBO	fluor. lights (8) 4' TWIN TUBE F.L.		

4/24/80 JLL
REV 4/15/80 JL

IGT MOBILE TEST TRAILER

FIGURE 11-4

new chemical equipment, the pressure and temperature sensors for the surface equipment and the strip chart recorders have all been field tested on the Girouard well test and are working satisfactorily.

A schematic of the overall data acquisition system is shown in Figure 11-5. The system is a computer based digital system with some analog back up. The system also operates via the IEEE-488 (HPIB) communications bus so that it will be compatible with Hewlett Packard equipment and other digital systems that use this same standard. It has the capability of performing some data reduction and analysis in the field. Since the bottom hole pressure and temperature will be obtained from the service company in the same format, it greatly facilitates the data acquisition and reporting.

11.4 Chemical Analysis

A. Sample Collection

The brine samples from the well will be collected in three Teflon-lined stainless steel cylinders of 500-ml capacity. For sampling, the cylinders will be linked in series to the sampling port. An

DATA ACQUISITION SYSTEM

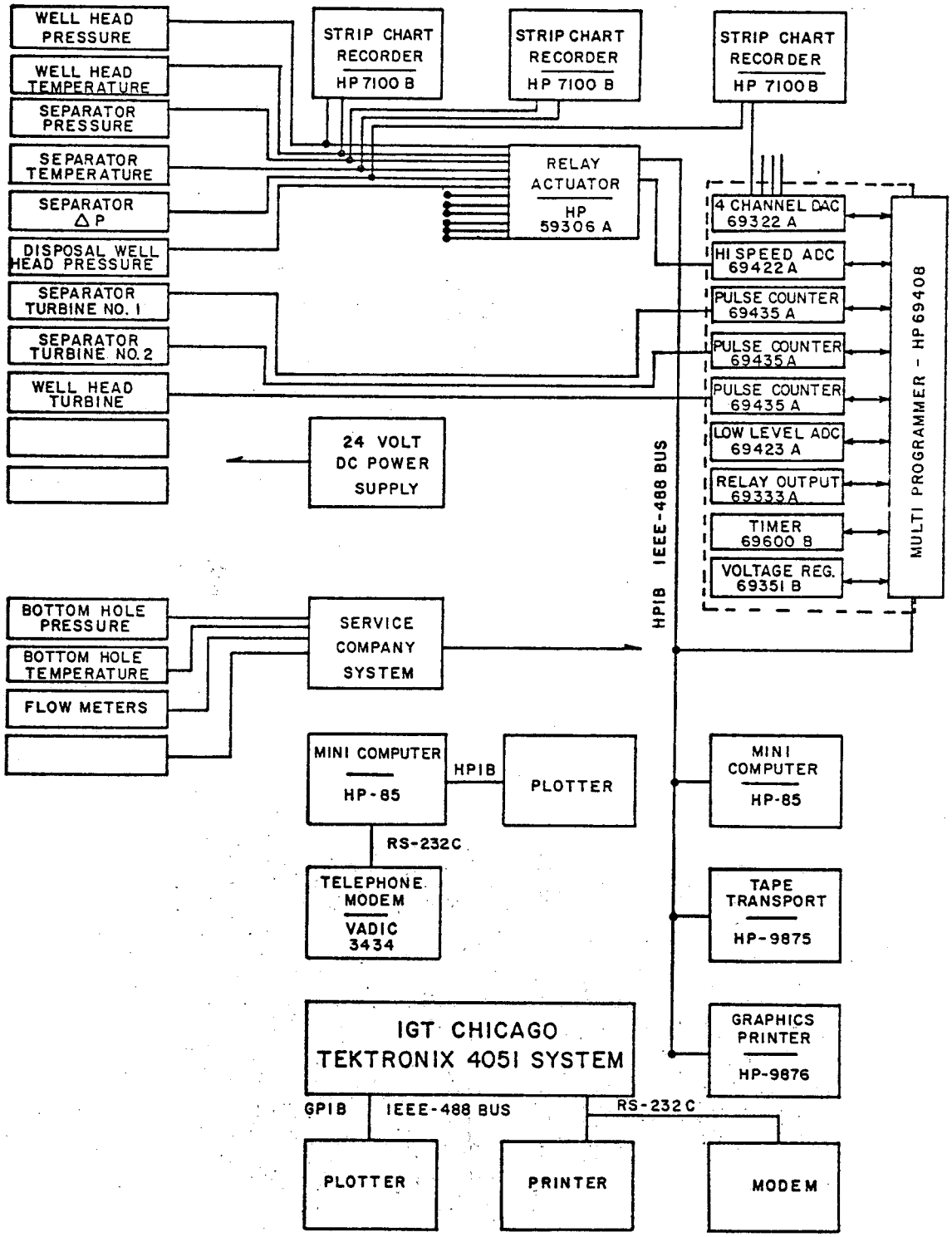


FIGURE 11-5

alternative method would be to collect brine in one cylinder at a time. The cylinders will be flushed with several volumes of brine to purge the air from the cylinders before the sample is taken. The valves on the cylinders will be closed, outlet first, inlet last, to trap and seal the sample under pressure. The sample cylinders will be cooled to near ambient temperature before analysis. The pressure in each cylinder will be maintained until the sample is ready for analysis.

The three steel cylinders, (A, B, and C), of RU brine are to be used for pH and specific conductance (Cylinder A), alkalinity (Cylinder B), and for gas analysis, total dissolved CO_2, including carbonate and bicarbonate species, and sulfide (Cylinder C).

Brine samples are also to be collected in plastic bottles cleaned first with dilute HNO_3(1:5) and rinsed four times with deionized water. Brine collected in these containers will first be passed through a loose plug of glass wool to reduce or remove oily matter. The samples in these bottles will be used for temperature measurements and for tests requiring raw acidified (RA), filtered untreated (FU), and filtered acidified (FA) samples.

Treatment	Tests
RU (Raw, untreated)	ph, Temperature, Total Dissolved CO_2, Alkalinity, Specific Conductance, Suspended Solids, Sulfide, Gas Analysis
RA (Raw, acidified with 3 ml HNO_3/liter)	Radioactivity
FU (Filtered through 0.45 m membrane, untreated)	Dissolved Solids, B, Cl^-, F^-, NH_3, SiO_2
FA (Filtered through 0.45 m membrane, acidified with 1:1 HNO_3 to a pH of 1.5. Note the amount of acid used)	As, Ba, Ca, Cd, Cl^-, Cr, Cu, Fe, K, Mg, Mn, Na, Pb, SO_4, Sr, Zn

B. TEST PROCEDURES FOR LIQUID SAMPLES

1. pH

Use a pH meter with automatic temperature compensation. Calibrate the pH meter with pH buffers of 7.0 and 4.0. Drain a portion of the sample from Cylinder A into a beaker and record the pH immediately. Do not stir the sample. The pH may drift down, then up, as the solution exsolves CO_2; record the lowest pH reading.

2. Temperature

Record the flowing brine temperature and measure the temperature of the brine in a freshly filled bottle or container.

3. Specific Conductance

Use a commerical instrument that has been calibrated with KCl at various temperatures for specific conductance. Record the temperature of the brine and the specific conductance in mhos/cm.

4. Suspended Solids

Weigh a piece of 0.45 um membrane filter, then filter a measured volume of sample through the membrane. Dry the filter at 110°C and report suspended solids in mg/l. Save the material for possible x-ray diffraction or emission spectrographic analysis.

5a. Alkalinity

Pipet 50.00 ml of the sample brine from Cylinder B into a 250 ml beaker. Place the electrodes of a calibrated pH meter into the sample and titrate with 0.02 N H_2SO_4. Add the standard acid in increments of 1 to 2 ml at the beginning of the titration and change the increments to 0.25 to 0.50 ml at pH = 5.0. The incremental volumes should be determined by the actual titration and the speed with which the pH is changing. Titrate the solution until the pH is 2.0. Tabulate values of pH and ml and determine the end point graphically from a plot of pH versus ml.

Calculate and report the alkalinity as mg HCO_3/liter. This procedure determines the total alkalinity, including the portion attributable to organic anions.

5b. Total CO_2

The brine in Cylinder C is used to determine total dissolved CO_2 (dissolved CO_2 and HCO_3) after the gas has been flashed off for GC analysis. The brine is drained from the steel cylinder into a volumetric cylinder to determine the brine volume for the gas to brine ratio. After measuring the volume, the brine is immediately

made alkaline to phenolphthalein with drops of 10 M NaOH (40 g NaOH to about 100 ml). Transfer 50 ml of this solution to the carbonate train. Add about 30 ml of water, acidify with 30 to 40 ml of 1:1 HCl, and purge the CO_2 into the tared Nesbitt bulb with nitrogen for 1 hour. Reweigh the Nesbitt bulb for the weight gain due to CO_2. Report as mg CO_2/liter.

6. Chloride

Pipet 1.00 ml of the sample (FU for on-site analysis immediately after collection of FA-HNO_3 for later analysis) into a 125 ml Erlenmeyer flask and dilute to approximately 50 ml. Add 10 drops of K_2CrO_4 indicator solution (5 g K_2CrO_4/100 ml deionized water) and titrate with 0.1 N $AgNO_3$ or equivalent until the end point persists. Report as mg Cl^-/l.

7. Silica

Silica may be determined directly from FU samples on-site if the determination is made soon after collection. Some precipitation of silica may occur if too much time elapses between collection and analysis. To prevent precipitation of silica, collect two FU samples diluted 1:1 and 1:4 with distilled water. The amount of silica should be determined in both dilutions; agreement between the two dilutions is evidence that no precipitation of silica occurred.

Volumes in the following procedure are based on the determination of silica in the undiluted FU samples. Some adjustments must be made for the determination in the diluted samples.

a. Pipet 1.00 ml of sample into a beaker. Add 10 ml of deionized water.

b. Pipet 1.00 ml of each standard into a beaker. Add 10 ml of NaCl solution (same concentration as sample) to each beaker containing standards.

c. Prepare a blank by adding 11.00 ml of NaCl solution in a beaker.

d. Pipet into each of the beakers in steps 1-3:

   1. 5.00 ml of 1.0 N HCl
   2. 5.00 ml of Na_2EDTA solution (10 g/l)
   3. 5.00 ml of ammonium molybdate solution (52 g $(NH_4)_6Mo_7O_{24}\cdot 4H_2O$ in deionized water, adjust pH to 7-8 with 10 M NaOH, dilute to 1 L with deionized water. Filter through 0.45 um membrane filter if necessary.

e. Wait 5 minutes and add 500 ml of $H_2C_4H_4O_6$ (tartaric acid) solution (100 g/l) to each beaker. Mix.

f. Wait 2 minutes and add 10.00 ml of Na_2SO_3 solution (170 g/l) to each beaker. Mix.

g. Wait 30 minutes and read the absorbance of the contents of each beaker at 700 nm in 1 cm. Use the blank as a reference.

h. Plot the data and graphically determine the SiO_2 concentration.

i. Report mg SiO_2/l.

8. Dissolved Solids

Pipet a volume of sample containing <200 mg dissolved solids into a pre-weighed container. Evaporate the liquid over a steam bath or in an oven (~80°C), then dry at 180°C for two hours or until constant weight is obtained. Report dissolved solids as mg dissolved solids/l.

Alernatively, the dissolved solids content may be calculated by adding the concentrations found for the cations and anions. Convert (HCO_3^-) to ($CO_3^=$) for calculation.

9. Boron

Pipet 2.00 ml of sample into a 30 ml Teflon (or plastic but not glass) beaker. Prepare a blank by pipetting 1.8 ml of deionized water into a Teflon beaker. Prepare standard boron solutions, of 0.01 and 0.025 mg B/l. To blank and standard solutions, add 0.2 ml of silica standard (same concentration as sample). Adjust the volume of the standards of 2.00 ml. To blank, standards, and samples, add two drops of concentrated HCl and two drops of concentrated H_2SO_4. Allow to cool, add 10.00 ml carmine solution (0.5 g carmine/liter of concentrated H_2SO_4) to blank, standards, and sample. Allow to stand for 1 hour. Set spectrophotometer to 600 nm. Use a 1 inch cell and read the absorbance of each sample with the blank as a reference. Determine boron graphically and report as mg B/l.

10. Sulfide

The remaining alkaline brine solution from Cylinder C is used for the sulfide determination. Use a specific ion electrode and follow the manufacturer's instructions.

11. Flouride

Use a specific ion electrode and follow the manufacturer's instructions.

12. Iron

Determine directly by atomic absorption spectrometry.

13. Barium

Measure with atomic absorption.

14. Sulfate

Prepare a chromatographic column as follows: Wash 80-200 mesh chromatographic grade alumina with deionized water. Allow alumina to settle, decant the supernatant liquid, and repeat the washing procedure until the supernatant liquid is clear. Transfer the alumina to a chromatographic column, wash with 50 ml of 1 M ammonium hydroxide, several 5 ml portions of 0.1 M ammonium hydroxide, and 50 ml of deionized water. Wash with 10 ml of 1 M HCl for the final wash.

Acidify the sample with 30% HCl to pH=0.5-1.0. Run the sample through the previously prepared chromatographic column, wash with 10 ml of 1 M HCl followed with a total of 25 ml of deionized water added in several portions. Elute the sulfate from the column by adding 5 ml of 1 M ammonium hydroxide followed by 20 ml of 0.1 M ammonium hydroxide. Add an additional 20 ml of 0.1 M ammonium hydroxide in 5 ml portions.

Wash with 25 ml of deionized water. Do not allow the column to become dry. Neutralize the eluted sample with dilute HCl and add 1 ml dilute HCl in excess, then dilute to approximately 200 ml with deionized water. Treat with 0.25 M $BaCl_2$ solution. Digest the precipitate for two hours, cool, filter, ash the paper, and heat in a muffle furnace (1000°C) until constant weight is attained. Report as mg $SO_4^=$/l.

15. Strontium

Determine directly by atomic absorption spectrometry. Use 1.00 ml of a La_2O_3-KCl mixture (117.3 g La_2O_3 dissolved in minimum amount of dilute HCl + 19.1 g KCl and add deionized water to 1000 ml) for each 10.00 ml sample or standard. Report as mg Sr/l.

16. Sodium

Determine directly by flame emission or atomic absorption spectrometry. Add ~1000 mg K/l to swamp potassium interference.

17. Potassium

Determine directly by flame emission or atomic absorption spectrometry. Swamp sodium interference by making the standards with 2000 mg Na/l. This may be done by adding 40 ml of a NaCl solution (5000 mg NaCl/l) to each 100 Ml K standard. Alternatively, use the actual concentration found in the samples for the potassium standards.

18. Calcium

Determine directly by atomic absorption spectrometry. Use 1.00 ml of La_2O_3 dissolved in small portions in 250 ml concentrated HCl (CAUTION) and diluted to 500 ml with deionized water) for each 10.00 ml sample or standard. Report as mg Ca/l.

19. Cadmium

Determine directly by atomic absorption spectrometry. Report as mg Cd/l.

20. Magnesium

See calcium determination. Report as mg Mg/l.

21. Ammonia

Collect a separate sample for this determination. Follow manufacturer's directions for specific ion electrode. Report as mg NH_3/l.

22. Zinc

Determine directly by atomic absorption spectrometry. Report as mg Zn/l.

23. Maganese

Trace amounts of maganese may be determined by atomic absorption spectrometry following an extraction procedure.

24. Arsenic

Arsenic may be determined by atomic absorption spectrometry after converting the metal to arsine. Care should be exercised

to prevent the absorption of radiation at the arsenic wavelengths by organic vapors.

25. Copper, Chromium, and/or Lead

Pipet a 100.00 ml sample into a 250 ml volumetric flask. Prepare a blank similarly and a standard containing 0.1 mg M^{++}/L in the extracted medium. Add two drops of bromphenol blue solution (0.1 g bromphenol blue dissolved in 100 ml of 50 percent ethanol) to each flask. Adjust the pH by adding 2.5 M NaOH (10 g NaOH in 1 L solution) dropwise until the blue color persists, then add 0.23 M HCl (25 ml concentrated HCl in deionized water and diluted to 1 l) until the blue color just disappears. Add 2.00 mL of 0.3 M HCl in excess. Add 5.00 mL of APDC solution (1 g ammonium pyrrolidine dithiocarbamate in deionized water diluted to 100 ml. Prepare fresh daily) and mix. Add 10.00 ml MIBK (methyl isobutyl ketone) and shake the flask and contents for three minutes. Allow the layers to separate and add deionized water until the MIBK layer is in the neck of the flask. Cu, Cr, and/or Pb will be determined on the MIBK extract by atomic absorption spectrometry.

26. Mercury

Mercury may be determined by flameless atomic absorption spectrometry.

27. Radioactivity

Samples to be submitted to the USGS for measurements of gross alpha, gross beta and gross gamma.

28. X-Ray Diffraction

The suspended solids collected on the filter should be subjected to x-ray diffraction techniques such that clays and minerals will be identified. A semi-quantitative determination of each material identified is desirable.

C. Test Procedures for Gas Samples

1. Standard Hydrocarbons

Use a gas chromatograph to determine C_1 - C_6 and C_{6+}. The standard analysis usually determines CO_2, N_2 and O_2 simultaneously. Report as mole percent of each element or compound.

2. Hydrogen, Ammonia, Hydrogen Sulfide, Helium

These gases should be determined by standard gas chromatography. Use the proper column, carrier gas, etc. to obtain the correct determination. Report as mole percent of each element or compound. Ammonia and H_2S will be estimated on-site using Draeger apparatus.

3. Radon-222

Evacuate the alpha counting chamber and admit a known amount of gas sample into the chamber. Count the Rn-222 and report as pCi ^{222}Rn/l. This measurement will be made by USGS with gas samples provided by IGT.

4. Mass Spectrometry

Subject a gas sample to mass spectrometry (from Z-1 to Z-400 and report the gases present. This determination is to be made on one sample only.)

D. On-Site Laboratory

The following determinations must be made at an on-site laboratory before precipitation occurs in the sample (within 30 minutes of the time the sample is collected): pH, T, specific conductance, dissolved solids (gravimetric), suspended solids, HCO_3^-, $CO_3^=$, Cl^- (FU samples), $S^=$, NH_3, SiO_2 (FU samples not diluted). Other determinations will be made later and in IGT's Chicago lab facilities. SiO_2 to be determined later, dilute one FU sample 1:1 with deionized water and dilute another FU sample 1:4 with deionized water. Determine SiO_2 on both samples. Collect separate samples for $S^=$ and NH_3. Gas analyses for C_1-C_6 hydrocarbons and CO_2 will be performed on-site using a gas chromatograph containing a thermal conductivity detector. CO_2 and H_2S will be estimated on-site using a Draeger apparatus.

Produced gas/water ratios will be calculated on-site using values of meter output corrected for actual composition of flow streams. Gas flows will be corrected for C_1-C_6, CO_2 and H_2O content. Liquid flows will be corrected for gas content determined by on-site flashing plus analysis of liberated gas.

E. Sampling Schedule

1. When the test schedule is known, advance phone calls will be made to the following organizations to alert them should they desire to take their own samples.

   - McNeese State University
   - USGS - Menlo Park & Bay St. Louis
   - Univeristy of Texas
   - L.S.U.

   All third party sampling must be approved and supervised by the Eaton Engineer in charge to insure proper safety and operational procedures. IGT will maintain a log of such samples and maintain contact for companies of lab results, resolution of any discrepanies and supporting of results obtained by third parties.

2. When the well has flowed 2400 BPD for several hours after bottoms up (step 2 of operating procedure), brine and gas samples will be collected. Wellhead pressure samples will be flashed to atmospheric pressure at location for gas/water ratio determination. Two samples each of brine and gas will be taken at separator pressure for laboratory analysis. In addition, raw and acidified brine samples will be collected from separator outputs at atmospheric pressure using procedure described above. Samples for radioactivity analysis will be provided to the USGS.

3. During the 96 hour build up, surface lines will be examined for scale formation and examples of any scale found will be shipped to IGT for analysis.

4. During the stepwise increase in flow rate, sample collection and analysis at each rate will be as follows:

    - At least twice daily, collect wellhead pressure samples and flash to determine gas/H_2O ratio until it is clear that consistent and more accurate data is being obtained from corrected gas and liquid flow meter readings.
    - Perform daily on-site analyses of samples from the separator using procedures previously described.
    - On the first, third and fifth day at each flow rate, collect samples from the separator gas and liquid output for subsequent lab analysis using procedures previously described.

5. During the last day of flow through the separator, additional separator pressure gas and liquid samples will be collected to be retained for up to one year for future analyses to resolve unanticipated issues. A few gallons of raw and acidified brine will also be stored at atmospheric pressure.

6. During disassembly of the testing equipment, it will be examined for any evidence of scale or corrosion. Observations will be documented and samples of any scale found will be shipped to IGT for analysis.

TABLE 11-1

ESTIMATED COST TO PERFORM

GEOPRESSURED - GEOTHERMAL TEST

MARTIN CROWN ZELLERBACH WELL NO. 2

Accounting Code	Item	Original Estimate
02	Field Labor	$ 38,000
09	Site	-0-
10	Drilling	-0-
11	Tangible	-0-
12	Expendables	12,000
13	Cementing	-0-
14	Perf., Acid	-0-
15	Equip. Rental	-0-
16	Contract Serv.	-0-
17	Freight & Trans.	23,000
18	Other	26,000
19	Insurance	-0-
20	Consultants	11,000
21	Land Use	-0-
24	Testing	506,000
	TOTAL	$616,000

12.0 PLUG AND ABANDONMENT OPERATIONS - TEST WELL

When the test well evaluation has been completed, the test well and the saltwater disposal well will be plugged and abandoned in accordance with the regulations of the Louisiana Office of Conservation. All salvable materials and supplies from the wells will be preserved and placed in storage. The well sites will be cleared and the locations restored to the satisfaction of all concerned parties.

12.1 Procedure for Plug and Abandonment

After a permit is obtained from the Louisiana Office of Conservation, a workover rig will be moved on location. The well will be killed by pumping 13.8 ppg mud down the tubing and up the casing prior to moving the rig on location.

The plug and abandonment procedure for the test well follows and the estimated costs for the operation are included in Table 12-1.

Day No.	Procedure
1	Finish moving in rig and installing equipment.
2	Remove christmas tree and install 5,000 psi working pressure blowout preventers and test them according to Eaton specifications.
3	Pull out of hole with 2-3/8 inch tubing. Pick up EZSV cement retainer and go in hole with retainer on tubing.

Day No.	Procedure
4	Set retainer at 16,600 feet and squeeze perforations with 200 sacks of cement. Final squeeze pressure should be 5,000 psi. Spot 25 sacks of cement on top of retainer.
5	Pull out of hole with tubing.
6	Remove blowout preventers and 7 inch tubing head. Install blowout preventers on 9-5/8 inch casing. Test blowout preventers.
7	Set a wireline bridge plug at approximately 12,000 feet. Run freepoint indicator in 7 inch casing and cut casing at freepoint at approximately 12,000 (estimated top of cement).
8	Pull out of hole laying down 7 inch casing.
9	Set cement retainer above cut casing at about 11,900 feet and spot 100 feet cement plug on top of retainer. Spot 100 feet cement plug at the surface inside the 9-5/8 inch casing.
10	Remove blowout preventers and 9-5/8 inch casing head. Cut all casing strings at least 4 feet below ground level and weld steel plate on the pipe stub.
11	Rig down equipment and move out rig.

TABLE 12-1

ESTIMATED COST TO PLUG

AND ABANDON TEST WELL

MARTIN CROWN ZELLERBACH WELL NO. 2

Accounting Code	Item	Original Estimate
02	Field Labor	$ 13,000
09	Site	95,000
10	Drilling	79,000
11	Tangible	11,000
12	Expendables	24,000
13	Cementing	28,000
14	Perf., Acid	-0-
15	Equip. Rental	10,000
16	Contract Serv.	44,000
17	Freight & Trans.	17,000
18	Other	3,000
19	Insurance	-0-
20	Consultants	-0-
21	Land Use	-0-
24	Testing	-0-
	TOTAL	$324,000

13.0 PLUG AND ABANDONMENT OPERATIONS - DISPOSAL WELL

Wellhead equipment will be the only salvageable material on this well. The plug and abandonment procedure for the disposal well follows and the estimated costs for the operation are included in Table 13-1.

13.1 Procedure for Plug and Abandonment

A. Rig up cementing truck and establish pump-in rate.

B. Fill 9-5/8 inch casing with cement from the bottom perforation to the surface. This will require about 2,475 cubic feet of light weight cement.

C. Allow cement to set up. Cut all casing strings at least 4 feet below ground level and weld steel plate on top of pipe stub.

TABLE 13-1

ESTIMATED COST TO PLUG

AND ABANDON DISPOSAL WELL

MARTIN CROWN ZELLERBACH WELL NO. 1

Accounting Code	Item	Original Estimate
02	Field Labor	$ -0-
09	Site	50,000
10	Drilling	-0-
11	Tangible	-0-
12	Expendables	-0-
13	Cementing	10,000
14	Perf., Acid	-0-
15	Equip. Rental	-0-
16	Contract Serv.	-0-
17	Freight & Trans.	-0-
18	Other	-0-
19	Insurance	-0-
20	Consultants	-0-
21	Land Use	-0-
24	Testing	-0-
	TOTAL	$ 60,000

14.0 COST SUMMARY AND TIME SCHEDULE

Included here is a summary of the cost esimates found in this book. Detailed cost estimates are included in this section.

The estimated cost for this project is as follows:

• Complete Test Well	$ 1,965,000
• Re-Enter and Complete Disposal Well	323,000
• Testing Costs	616,000
• Plug and Abandon Test Well	324,000
• Plug and Abandon Disposal Well	60,000
• Eaton Operating Company Test Fee	113,000
TOTAL	$ 3,401,000

Figure 14-1 is a time schedule graph indicating the estimated time for the various operations.

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3100 Edloe
Houston, Texas 77027
(713) 627-9764

DETAILED MILESTONE SCHEDULE

MARTIN-CROWN ZELLERBACH WELL NO. 2

ACTIVITIES

1. Re-Enter & Complete Test Well.
2. Move Rig to Disposal Site and Install Equipment.
3. Re-Enter & Complete Disposal Well.
4. Install Production & Data Acquisition Equipment.
5. Run Pressure & Temperature Gradients & Place H.P. Pressure Gauge in Tubing.
6. Flow Well for Initial 24 Hour Test Period.
7. Increase Rate to 5000 BWPD for 5 Days.
8. Increase Rate to 10,000 BWPD For 5 Days.
9. Increase Production Rate to Maximum Potential or Limits of Equipment or Disposal Well.
10. Shut Well In For Build-Up Test.
11. Disconnect & Move Out Test Equipment.
12. Move In Rig and Plug and Abandon Test Well.
13. Move In Rig and Plug and Abandon Disposal Well.
14. Restore Site.

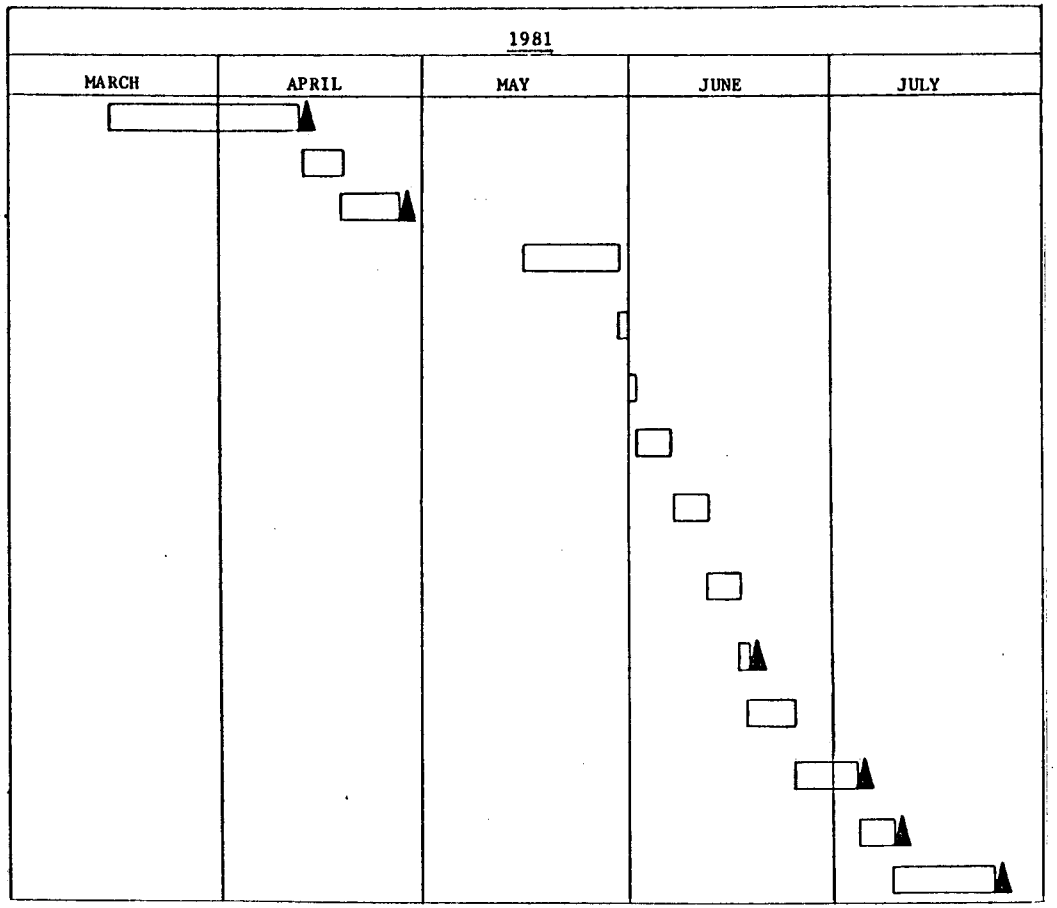


FIGURE 14-1

EATON OPERATING COMPANY, INC.
DETAILED COST ESTIMATE

LEASE & WELL Crown Zellerbach No. 2 | DATE 2-6-81 | BY RM
PROSPECT WOO Test Well | WILDCAT X | DEVELOPMENT
LOCATION Livingston Parish | LAND X | WATER
FIELD | T.D. 17,000 | COMPL ZONES One

TOTAL ESTIMATED COST OF PROJECT (6 Pages)	Accounting Code	Completed Well Cost
DRILLING EXPENSE		
a. Move In & Move Out		95
b. Footage: ft. at $ /Ft.		
c. Drilling DW w DP: days at $ /day.		
d. Drilling DW wo DP: days at $ /day.		
e. Testing DW w DP: days at $ /day.		
f. Testing DW w days at $ /day.		
g. Completion DW w DP: days at $ /day.		
h. Completion DW wo DP: days at $ /day.		168
i. Completion Rig days at $ /day.		120
j. Other		
TOTAL	10	383
LOCATION EXPENSE		
a. Permits		1
b. Surveyor		-
c. Build Road & Locn		60
d. Dredging		20
e. Damages		-
f. Clean Up		165
g. Other		
TOTAL	09	246
MUD & COMPLETION FLUID EXPENSE		
a. Mud, Chemicals, Oil		30
b. Mud Engineer days at $ /day.		
c. Completion Fluid		180
d. Other		10
TOTAL	12	220
BITS - DRILLING & COMPLETION		
a. No. - Size at $ each.		4
b. No. - Size at $ each.		2
c. No. - Size at $ each.		
d. No. - Size at $ each.		
e. No. - Size at $ each.		
f. Other		1
TOTAL	12	7

CEMENTING SERVICE & EQUIPMENT

	Cement	Service	Float Eq.	Cent & Scratch	
a. Cond.					
b. Surf					
c. Inter					
d. Prod.					40
e. Liner					
f. Other					
g. Squeeze Work					
h. PSA Charges					30
i. Other					25
					10
TOTAL				13	105

A

COST ESTIMATE: WELL: CROWN ZELLERBACH #2
TOTAL PROJECT

	Accounting Code	
CONTRACT SERVICES		
a. Drive Pipe: Hammer, Operator, Welder, etc.		
b. Conductor Casing: Tools, Tongs, Operator, Crews, etc.		
c. Surface Casing: Tools, Tongs, Operator, Crews, etc.		
d. Intermediate Casing: Tools, Tongs, Operator, Crews, etc		
e. Production Casing: Tools, Tongs, Operator, Crews, etc.		20
f. Liner Casing: Tools, Tongs, Operator, Crews, etc.		
g. Mud Logger: _____ days at $_____/day.		
h. Wireline Work: Set BP, Storm Chokes, BPV, etc.		20
i. Tubing Make Up: Tongs, Crews, Computer, etc.		10
j. Other:		30
		10
TOTAL	16	90
PROFESSIONAL SERVICES		
a. Consultant: Office Work		
b. Consultant: Wellsite Supervision		
Drilling: _____ days at $_____/day.		
Completion: _____ days at $_____/day.		50
c. Other		12
TOTAL	02	62
EQUIPMENT RENTAL		
a. Surface Equipment:		
Desilter _____ days at $_____/day.		4
Centrifuge _____ days at $_____/day.		-
Degasser _____ days at $_____/day.		2
Shaker _____ days at $_____/day.		-
Geolograph _____ days at $_____/day.		3
Pit Level _____ days at $_____/day.		4
Adj. Choke _____ days at $_____/day.		3
Other _____ days at $_____/day.		8
b. Downhole Drilling Equipment (DP, DC, Stab, etc.) _____ days at $_____/day.		42
c. Completion Equipments(BOP, Tubing tools, etc.) _____ days at $_____/day.		42
d. Other		11
TOTAL	15	119
ELECTRIC LOGGING & PERFORATING		
a. Log Type _____ Interval _____		
b. Log Type _____ Interval _____		
c. Log Type _____ Interval _____		
d. Log Type _____ Interval _____		
e. Cement Bond		15
f. GR/Correlation		13
g. Set WL Packers		-
h. Perf		75
i. Perf		
j. Other		
TOTAL	14	103
CORING SERVICE & ANALYSIS		
a. Conventional Core 3rd Party Charges		
b. SWC: No. _____ Cores at $_____/Core.		
c. Core Analysis		
d. Other		
TOTAL	14	

B

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
TOTAL PROJECT

	Accounting Code	
WELL STIMULATION SERVICES		
a. Swab Unit: _____ days at $_____/day.		
b. Nitrogen Service		
c. Acidize		15
d. Acidize		
e. Acidize		
f. Frac		
g. Frac		
h. Other		
TOTAL	14	15
TESTING SERVICES		
a. DST: No _____ at $_____/Test.		
b. Wireline FT Tests: No _____ at $_____/Test.		
c. Production Test Equipment & Service		
d. Casing Inspection		17
e. Tubing Inspection		17
f. Tubing Pressure Testing		
g. Other		5
TOTAL	16	39
DIRECTIONAL DRILLING EXPENSE		
a. Directional Tools & Services: _____ days at $_____/day		
b. Directional Surveys		
c. Other		
TOTAL	16	
TRANSPORTATION		
a.		33
b.		30
c.		
d.		
TOTAL	17	63
SALARIED PERSONNEL		
a.		
b.		
c.		
TOTAL	12	
FUEL, POWER, WATER		
a. Fuel:	12	66
b. Water:	12	6
c. Power:	12	4
d. Other:	18	23
TOTAL		99
OTHER INTANGIBLE EXPENSES		
a. Operator Fee	21	145
b. Landowner Fee	21	30
c. Insurance	19	30
d. Unanticipated Costs		242
TOTAL		447

C

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
TOTAL PROJECT

	Accounting Code	
CASING, LINERS, SETTING SERVICES		
a. Drive Pipe:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
b. Surface Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
c. Intermediate Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
d. Production Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
e. Liner Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
f. Other_____		
_____		
TOTAL	11	314
TUBING		
a. Tubing Strings Required: _____		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		290
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
b. Internal Coating:_____		
c. Other_____		
_____		
TOTAL	11	290
DOWNHOLE EQUIPMENT		
a. Packers_____		
b. Nipples_____		
c. Flow Cplgs._____		
d. Blast Joints_____		
e. Other_____		10
_____		
TOTAL	11	10
WELLHEAD EQUIPMENT		
a. Bradenhead: (___in____WP BTM) (___in____WP TOP)		5
b. Casinghead: (___in____WP BTM) (___in____WP TOP)		10
c. Casinghead: (___in____WP BTM) (___in____WP TOP)		
d. Tubinghead: (___in____WP BTM) (___in____WP TOP)		
e. Casing & Tubing Hangers_____		
f. Xmas Tree: Single_____ Dual_____ Triple_____		
No. _____ Valves with _____ WP _____		
g. Other_____		45
_____		
TOTAL	11	60

D

TESTING COST ESTIMATE: WELL: CROWN ZELLERBACH #2

TOTAL PROJECT

SURFACE EQUIPMENT & PRESSURE VESSELS		Accounting Code	
a. Separators:	DOE Equipment		-
b. Tanks:	2 100 bbl calibration tanks @ $40		1
c. Filters:	Back flushing filter @ $300		7
d. Meters:	4 Howco LCD readouts @ $60		2
e. Pumps:	Meter calibration pump @ $150		4
f. Compressors:	Instrument air supply @ $35		1
g. Dead Weight Tester:	Manifold @ $35		1
h. Scrubbers:			-
i. Dehydrators:			-
j. Gas Coolers:	Buy new unit		15
k. Water Coolers:			
	TOTAL	24	31

PIPING, FITTINGS, FLANGES			
a.	Pit lines @ 480		10
b.	Casing kill line @ 100		2
c.	Tubing kill line @ 100		2
d.	10,000 psi flange @20		1
e.	3500 of H_2S 3" line pipe flow line @ $4/ft.		14
f.			
	TOTAL	24	29

FOUNDATIONS			
a.	Roustabout crews		10
b.	Board road upkeep and rental @ 4500/wk.		27
c.	Other location costs		5
d.	Signs		1
e.			
	TOTAL	24	43

WIRELINE SERVICE			
a.	Gearheart Industries BH sampling		10
b.	Wireline BHP recording @ 3100/day		70
c.			
	TOTAL	24	80

CHEMICAL INHIBITOR COSTS			
a.	Scale chemical		3
b.	Corrosion chemical		3
c.	Service cost		5
	TOTAL	12	11

LABOR			
a.	Supervisor @ 840/day		18
b.	4 testers @ 1,680/day		36
c.	Subsistance @ $25 each		3
	TOTAL	24	57

Note: 21 days testing
21 days preparing to test

E

TESTING COST ESTIMATE: WELL: CROWN ZELLERBACH #2

TESTING COST

	Accounting Code	
LIGHTING, POWER, LIVING FACILITIES		
a. Living quarters, telephones, etc.		10
b. Power and lights		10
c. Water		3
TOTAL	18	23
TRANSPORTATION		
a. $500/day		11
b. Extra hauling		10
TOTAL	17	21
SUPERVISION		
a. 3 men at 660/day (42 days)		28
b. 3 men at 150/day subsistance		7
TOTAL	02	35
CONTRACT SAMPLING & ANALYSIS IGT	24	90
OTHER TESTING COSTS		
a. H_2S safety equipment @ $860/day		18
b. H_2S metallurgy inspection and conditioning		50
c. Recondition equipment after test		10
d. 440 bbl mud kill system at $800/day		34
e. Disposal pump and 220 bbl tank @ $250/day		11
f. Flow line bypass choke at $105		3
g. Pilot light for flare at $30		1
h. SWACO choke for casing at $20		1
i. Sand detector @ $70		2
j.		
k.		
l.		
m.		
TOTAL	24	130
OUTSIDE CONSULTANTS	20	10
UNANTICIPATED TESTING COSTS		56
EOC FIXED FEES		113
SUBTOTAL		729
GRAND TOTAL FOR PROJECT		$3,401,000

F

EATON OPERATING COMPANY, INC.
DETAILED COST ESTIMATE

LEASE & WELL CROWN ZELLERBACH #2 | DATE 2/5/80 | BY RM
PROSPECT WOO TEST WELL | WILDCAT X | DEVELOPMENT
LOCATION LIVINGSTON PARISH | LAND X | WATER
FIELD | T.D. 17,000 | COMPL ZONES One

ESTIMATED COST TO RE-ENTER AND COMPLETE TEST WELL
(4 Pages)

	Accounting Code	Completed Well Cost
DRILLING EXPENSE		
a. Move In & Move Out 75,000		75
b. Footage: ft. at $ /Ft.		
c. Drilling DW w DP: days at $ /day.		
d. Drilling DW wo DP: days at $ /day.		
e. Testing DW w DP: days at $ /day.		
f. Testing DW w days at $ /day.		
g. Completion DW w DP: 28 days at $ 6000 /day.		168
h. Completion DW wo DP: days at $ /day.		
i. Completion Rig days at $ /day.		
j. Other		
TOTAL	10	243
LOCATION EXPENSE		
a. Permits		1
b. Surveyor		
c. Build Road & Locn		50
d. Dredging		20
e. Damages		
f. Clean Up		20
g. Other		
TOTAL	09	91
MUD & COMPLETION FLUID EXPENSE		
a. Mud, Chemicals, Oil water base mud		10
b. Mud Engineer days at $ /day.		
c. Completion Fluid oil base mud		180
d. Other tank rental		10
TOTAL	12	200
BITS - DRILLING & COMPLETION		
a. No. 3 - 8-1/2 Size at $ 700 each.		2
b. No. 3 - 4-1/2 Size at $ 500 each.		2
c. No. - Size at $ each.		
d. No. - Size at $ each.		
e. No. - Size at $ each.		
f. Other 2 Junk mills @ 500 each		1
TOTAL	12	5

CEMENTING SERVICE & EQUIPMENT

	Cement	Service	Float Eq.	Cent & Scratch	
a. Cond.					
b. Surf					
c. Inter					
d. Prod.	20	10	5	5	40
e. Liner					
f. Other					
g. Squeeze Work	2 Squeeze jobs				30
h. P&A Charges					
i. Other					
TOTAL				13	70

G

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
COMPLETION COST

		Accounting Code	
CONTRACT SERVICES			
a.	Drive Pipe: Hammer, Operator, Welder, etc.		
b.	Conductor Casing: Tools, Tongs, Operator, Crews, etc.		
c.	Surface Casing: Tools, Tongs, Operator, Crews, etc.		
d.	Intermediate Casing: Tools, Tongs, Operator, Crews, etc		
e.	Production Casing: Tools, Tongs, Operator, Crews, etc.		10
f.	Liner Casing: Tools, Tongs, Operator, Crews, etc.		
g.	Mud Logger: ____ days at $____/day.		
h.	Wireline Work: Set BP, Storm Chokes, BPV, etc. PKR		10
i.	Tubing Make Up: Tongs, Crews, Computer, etc.		10
j.	Other: Casing Pressure Test		10
	TOTAL	16	40
PROFESSIONAL SERVICES			
a.	Consultant: Office Work		
b.	Consultant: Wellsite Supervision		
	Drilling: ____ days at $____/day.		
	Completion: 4 men 36 days at $ 875 /day.		32
c.	Other 4 men x $50/day x 36 living & travel		8
	TOTAL	02	40
EQUIPMENT RENTAL			
a.	Surface Equipment:		
	Desilter 36 days at $ 100 /day.		4
	Centrifuge ____ days at $____/day.		
	Degasser 36 days at $ 50 /day.		2
	Shaker ____ days at $____/day.		
	Geolograph 36 days at $ 80 /day.		3
	Pit Level 36 days at $ 100 /day.		4
	Adj. Choke 36 days at $ 80 /day.		3
	Other Trip Tank 36 days at $ 100 /day.		4
b.	Downhole Drilling Equipment (DP, DC, Stab, etc.) 36 days at $ 1000 /day.		36
c.	Completion Equipments (BOP, Tubing tools, etc.) 36 days at $ 1000 /day.		36
d.	Other 36 days @ $300/day		11
	TOTAL	15	103
ELECTRIC LOGGING & PERFORATING			
a.	Log Type ____ Interval ____		
b.	Log Type ____ Interval ____		
c.	Log Type ____ Interval ____		
d.	Log Type ____ Interval ____		
e.	Cement Bond		10
f.	GR/Correlation		10
g.	Set WL Packers		
h.	Perf		60
i.	Perf		
j.	Other		
	TOTAL	14	80
CORING SERVICE & ANALYSIS			
a.	Conventional Core 3rd Party Charges		
b.	SWC: No. ____ Cores at $____/Core.		
c.	Core Analysis		
d.	Other		
	TOTAL	14	

H

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
COMPLETION COST

	Accounting Code	
WELL STIMULATION SERVICES		
a. Swab Unit: _____ days at $_____/day.		
b. Nitrogen Service		
c. Acidize		
d. Acidize		
e. Acidize		
f. Frac		
g. Frac		
h. Other		
TOTAL	14	
TESTING SERVICES		
a. DST: No _____ at $_____/Test.		
b. Wireline FT Tests: No _____ at $_____/Test.		
c. Production Test Equipment & Service		
d. Casing Inspection ($1.00/ft.)		17
e. Tubing Inspection ($1.00/ft.)		17
f. Tubing Pressure Testing		
g. Other X-mas tree testing		5
TOTAL	16	39
DIRECTIONAL DRILLING EXPENSE		
a. Directional Tools & Services: _____ days at $_____/day		
b. Directional Surveys		
c. Other		
TOTAL	16	
TRANSPORTATION		
a. $500/day x 36 days		18
b. Extra hauling		20
c.		
d.		
TOTAL	17	38
SALARIED PERSONNEL		
a.		
b.		
c.		
TOTAL	12	
FUEL, POWER, WATER		
a. Fuel: $1200/day x 36 days	12	44
b. Water: $100/day x 36 days	12	4
c. Power: $50/day x 36 days	12	2
d. Other: Telephone, trailers, septic tanks	18	10
TOTAL		60
OTHER INTANGIBLE EXPENSES		
a. Operator Fee	21	60
b. Landowner Fee	21	30
c. Insurance	19	30
d. Unanticipated Costs		177
TOTAL		297

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2

COMPLETION COST

		Accounting Code	
CASING, LINERS, SETTING SERVICES			
a.	Drive Pipe:		
	_____Ft. ____OD ____# ____Gr____Thd $____./Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
b.	Surface Casing:		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
c.	Intermediate Casing:		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
d.	Production Casing:		
	_____Ft. ____" OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
e.	Liner Casing:		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
f.	Other_____		
	TOTAL	11	314
TUBING			
a.	Tubing Strings Required: _____		
	17,000 Ft. 2-3/8"OD 5.95 #C-75 Gr8RD Thd $ 17 /Ft.		290
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
	_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
b.	Internal Coating:_____		
c.	Other_____		
	TOTAL	11	290
DOWNHOLE EQUIPMENT			
a.	Packers_____		
b.	Nipples_____		
c.	Flow Cplgs._____		
d.	Blast Joints_____		
e.	Other_____		
	TOTAL	11	
WELLHEAD EQUIPMENT			
a.	Bradenhead: (___in____WP BTM) (___in____WP TOP)		5
b.	Casinghead: (___in____WP BTM) (___in____WP TOP)		10
c.	Casinghead: (___in____WP BTM) (___in____WP TOP)		
d.	Tubinghead: (___in____WP BTM) (___in____WP TOP)		
e.	Casing & Tubing Hangers_____		
f.	Xmas Tree: Single_____ Dual_____ Triple_____		
	No. _____ Valves with _____ WP _____		
g.	Other_____ H_2S trim on valves		40
	TOTAL	11	55
		SUBTOTAL	$1,965,000

J

EATON OPERATING COMPANY, INC.
DETAILED COST ESTIMATE

LEASE & WELL CROWN ZELLERBACH #1 — DATE 2/4/81 — BY RM
PROSPECT DISPOSAL WELL — WILDCAT x — DEVELOPMENT
LOCATION LIVINGSTON PARISH, LA — LAND x — WATER
FIELD — T.D. — COMPL ZONES ONE

ESTIMATE TO RE-ENTER AND COMPLETE DISPOSAL WELL
(4 Pages)

	Accounting Code	Completed Well Cost
DRILLING EXPENSE		
a. Move In & Move Out		10
b. Footage: ft. at $ /Ft.		
c. Drilling DW w DP: days at $ /day.		
d. Drilling DW wo DP: days at $ /day.		
e. Testing DW w DP: days at $ /day.		
f. Testing DW w days at $ /day.		
g. Completion DW w DP: days at $ /day.		
h. Completion DW wo DP: days at $ /day.		
i. Completion Rig 10 days at $ 6000 /day.		60
j. Other		
TOTAL	10	70
LOCATION EXPENSE		
a. Permits		
b. Surveyor		
c. Build Road & Locn		10
d. Dredging		
e. Damages		
f. Clean Up		10
g. Other		
TOTAL	09	20
MUD & COMPLETION FLUID EXPENSE		
a. Mud, Chemicals, Oil		10
b. Mud Engineer days at $ /day.		
c. Completion Fluid		
d. Other		
TOTAL	12	10
BITS - DRILLING & COMPLETION		
a. No. 2 - 8-3/4" Size at $ 700 each.		2
b. No. - Size at $ each.		
c. No. - Size at $ each.		
d. No. - Size at $ each.		
e. No. - Size at $ each.		
f. Other		
TOTAL	12	2

CEMENTING SERVICE & EQUIPMENT

	Cement	Service	Float Eq.	Cent & Scratch	
a. Cond.					
b. Surf					
c. Inter					
d. Prod.					
e. Liner					
f. Other					
g. Squeeze Work					
h. P&A Charges					
i. Other					
TOTAL					13

K

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 1
DISPOSAL WELL COMPLETION

		Accounting Code	
CONTRACT SERVICES			
a.	Drive Pipe: Hammer, Operator, Welder, etc.		
b.	Conductor Casing: Tools, Tongs, Operator, Crews, etc.		
c.	Surface Casing: Tools, Tongs, Operator, Crews, etc.		
d.	Intermediate Casing: Tools, Tongs, Operator, Crews, etc		
e.	Production Casing: Tools, Tongs, Operator, Crews, etc.		
f.	Liner Casing: Tools, Tongs, Operator, Crews, etc.		
g.	Mud Logger: ____ days at $____/day.		
h.	Wireline Work: Set BP, Storm Chokes, BPV, etc.		
i.	Tubing Make Up: Tongs, Crews, Computer, etc.		10
j.	Other:		
	TOTAL	16	10
PROFESSIONAL SERVICES			
a.	Consultant: Office Work		
b.	Consultant: Wellsite Supervision		
	Drilling: ____ days at $____/day.		
	Completion: 4 men 10 days at $ 875 /day.		9
c.	Other 4 men x $50/day x living and travel		2
	TOTAL	02	11
EQUIPMENT RENTAL			
a.	Surface Equipment:		
	Desilter ____ days at $____/day.		
	Centrifuge ____ days at $____/day.		
	Degasser ____ days at $____/day.		
	Shaker ____ days at $____/day.		
	Geolograph ____ days at $____/day.		
	Pit Level ____ days at $____/day.		
	Adj. Choke ____ days at $____/day.		
	Other 10 days at $ 200 /day.		2
b.	Downhole Drilling Equipment (DP, DC, Stab, etc.)		
	10 days at $ 300 /day.		3
c.	Completion Equipments(BOP, Tubing tools, etc.)		
	10 days at $ 300 /day.		3
d.	Other		
	TOTAL	15	8
ELECTRIC LOGGING & PERFORATING			
a.	Log Type ____ Interval ____		
b.	Log Type ____ Interval ____		
c.	Log Type ____ Interval ____		
d.	Log Type ____ Interval ____		
e.	Cement Bond		5
f.	GR/Correlation		3
g.	Set WL Packers		
h.	Perf		15
i.	Perf		
j.	Other		
	TOTAL	14	23
CORING SERVICE & ANALYSIS			
a.	Conventional Core 3rd Party Charges		
b.	SWC: No. ____ Cores at $____/Core.		
c.	Core Analysis		
d.	Other		
L	TOTAL	14	

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 1
DISPOSAL WELL COMPLETION

	Accounting Code	
WELL STIMULATION SERVICES		
a. Swab Unit: _____ days at $_____/day.		
b. Nitrogen Service		
c. Acidize		15
d. Acidize		
e. Acidize		
f. Frac		
g. Frac		
h. Other		
TOTAL	14	15
TESTING SERVICES		
a. DST: No _____ at $_____/Test.		
b. Wireline FT Tests: No _____ at $_____/Test.		
c. Production Test Equipment & Service		
d. Casing Inspection		
e. Tubing Inspection		
f. Tubing Pressure Testing		
g. Other		
TOTAL	16	
DIRECTIONAL DRILLING EXPENSE		
a. Directional Tools & Services: _____ days at $_____/day		
b. Directional Surveys		
c. Other		
TOTAL	16	
TRANSPORTATION		
a.		10
b.		
c.		
d.		
TOTAL	17	10
SALARIED PERSONNEL		
a.		
b.		
c.		
TOTAL	12	
FUEL, POWER, WATER		
a. Fuel: $1200/day	12	12
b. Water: $100/day	12	1
c. Power: $50/day	12	1
d. Other: Living facilities, telephones, etc	18	10
TOTAL		24
OTHER INTANGIBLE EXPENSES		
a. Operator Fee	21	85
b. Landowner Fee	21	-
c. Insurance	19	-
d. Unanticipated Costs 10%		30
TOTAL		115

M

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 1

DISPOSAL WELL COMPLETION

CASING, LINERS, SETTING SERVICES	Accounting Code	
a. Drive Pipe:		
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
b. Surface Casing:		
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
c. Intermediate Casing:		
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
d. Production Casing:		
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
e. Liner Casing:		
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
_____Ft. _____OD _____# ____Gr____Thd $_____/Ft.		_____
f. Other_____		_____
_____		_____
TOTAL	11	_____

TUBING		
a. Tubing Strings Required: _____		_____
_____ Ft. _____OD_____#_____Gr____Thd $_____/Ft.		_____
_____ Ft._____OD_____#_____Gr____Thd $_____/Ft.		_____
_____ Ft._____OD_____#_____Gr____Thd $_____/Ft.		_____
_____ Ft._____OD_____#_____Gr____Thd $_____/Ft.		_____
b. Internal Coating:_____		_____
c. Other_____		_____
_____		_____
TOTAL	11	_____

DOWNHOLE EQUIPMENT		
a. Packers_____		_____
b. Nipples_____		_____
c. Flow Cplgs._____		_____
d. Blast Joints_____		_____
e. Other_____		_____
_____		_____
TOTAL	11	_____

WELLHEAD EQUIPMENT		
a. Bradenhead: (___in_____WP BTM) (___in_____WP TOP)		_____
b. Casinghead: (___in_____WP BTM) (___in_____WP TOP)		_____
c. Casinghead: (___in_____WP BTM) (___in_____WP TOP)		_____
d. Tubinghead: (___in_____WP BTM) (___in_____WP TOP)		_____
e. Casing & Tubing Hangers_____		_____
f. Xmas Tree: Single_____ Dual_____ Triple_____		
No. _____ Valves with _____ WP _____		_____
g. Other_____		5
_____		_____
TOTAL	11	5
	SUBTOTAL	$323,000

N

TESTING COST ESTIMATE: WELL: CROWN ZELLERBACH #2
TESTING COST

		Accounting Code	
SURFACE EQUIPMENT & PRESSURE VESSELS			
a. Separators:	DOE Equipment		-
b. Tanks:	2 100 bbl calibration tanks @ $40		1
c. Filters:	Back flushing filter @ $300		7
d. Meters:	4 Howco LCD readouts @ $60		2
e. Pumps:	Meter calibration pump @ $150		4
f. Compressors:	Instrument air supply @ $35		1
g. Dead Weight Tester:	Manifold @ $35		1
h. Scrubbers:			-
i. Dehydrators:			-
j. Gas Coolers:	Buy new unit		15
k. Water Coolers:			
TOTAL		24	31
PIPING, FITTINGS, FLANGES			
a.	Pit lines @ 480		10
b.	Casing kill line @ 100		2
c.	Tubing kill line @ 100		2
d.	10,000 psi flange @ 20		1
e.	3500 of H_2S 3" line pipe flow line @$4/ft.		14
f.			
TOTAL		24	29
FOUNDATIONS			
a.	Roustabout crews		10
b.	Board road upkeep and rental @ $4,500/wk		27
c.	Other location costs		5
d.	Signs		1
e.			
TOTAL		24	43
WIRELINE SERVICE			
a.	Gearheart Industries BH sampling		10
b.	Wireline BHP recording @ 3100/day		70
c.			
TOTAL		24	80
CHEMICAL INHIBITOR COSTS			
a.	Scale chemical		3
b.	Corrosion chemical		3
c.	Service cost		5
TOTAL		12	11
LABOR			
a.	Supervisor @ 840/day		18
b.	4 Testsers @ 1,680/day		36
c.	Subsistance @ $25 each		3
TOTAL		24	57

Note: 21 days testing
21 days preparing to test

TESTING COST ESTIMATE: WELL: CROWN ZELLERBACH #2

TESTING COST

	Accounting Code	
LIGHTING, POWER, LIVING FACILITIES		
a. Living quarters, telephones, etc.		10
b. Power and lights		10
c. Water		3
TOTAL	18	23
TRANSPORTATION		
a. $500/day		11
b. Extra hauling		10
TOTAL	17	21
SUPERVISION		
a. 3 men at 660/day (42 days)		28
b. 3 men at 150/day subsistance		7
TOTAL	02	35
CONTRACT SAMPLING & ANALYSIS IGT	24	90
OTHER TESTING COSTS		
a. H_2S safety equipment @ $860/day		18
b. H_2S metallurgy inspection and conditioning		50
c. Recondition equipment after test		10
d. 440 bbl kill system at $800/day		34
e. Disposal pump and 220 bbl tank @ 250/day		11
f. Flow line bypass choke at $105		3
g. Pilot light for flare at #30		1
h. SWACO choke for casing at $20		1
i. Sand Detector @ $70		2
j.		
k.		
l.		
m.		
TOTAL	24	130
OUTSIDE CONSULTANTS	20	10
UNANTICIPATED TESTING COSTS		56
EOC FIXED FEES		
SUBTOTAL		616

P

EATON OPERATING COMPANY, INC.
DETAILED COST ESTIMATE

LEASE & WELL CROWN ZELLERBACH #2 | DATE 2/5/81 | BY RM
PROSPECT WOO TEST WELL | WILDCAT X | DEVELOPMENT
LOCATION LIVINGSTON PARISH | LAND X | WATER
FIELD | T.D. 17,000 | COMPL ZONES One

ESTIMATED TO PLUG AND ABANDON TEST WELL
(4 Pages)

	Accounting Code	Completed Well Cost
DRILLING EXPENSE		
a. Move In & Move Out		10
b. Footage: ft. at $ /Ft.		
c. Drilling DW w DP: days at $ /day.		
d. Drilling DW wo DP: days at $ /day.		
e. Testing DW w DP: days at $ /day.		
f. Testing DW w days at $ /day.		
g. Completion DW w DP: days at $ /day.		
h. Completion DW wo DP: days at $ /day.		
i. Completion Rig 10 days at $ 6000 /day.		60
j. Other		
TOTAL	10	70
LOCATION EXPENSE		
a. Permits		
b. Surveyor		
c. Build Road & Locn		
d. Dredging		
e. Damages		
f. Clean Up		85
g. Other		
TOTAL	09	85
MUD & COMPLETION FLUID EXPENSE		
a. Mud, Chemicals, Oil		10
b. Mud Engineer days at $ /day.		
c. Completion Fluid		
d. Other		
TOTAL	12	10
BITS - DRILLING & COMPLETION		
a. No. - Size at $ each.		
b. No. - Size at $ each.		
c. No. - Size at $ each.		
d. No. - Size at $ each.		
e. No. - Size at $ each.		
f. Other		
TOTAL	12	

CEMENTING SERVICE & EQUIPMENT

	Cement	Service	Float Eq.	Cent & Scratch	
a. Cond.					
b. Surf					
c. Inter					
d. Prod.					
e. Liner					
f. Other					
g. Squeeze Work					
h. P&A Charges: Spot Plugs					25
i. Other					
TOTAL					13	25

Q

COST ESTIMATE: WELL: CROWN ZELLERBACH #2

P & A TEST WELL

	Accounting Code	
CONTRACT SERVICES		
a. Drive Pipe: Hammer, Operator, Welder, etc.		
b. Conductor Casing: Tools, Tongs, Operator, Crews, etc.		
c. Surface Casing: Tools, Tongs, Operator, Crews, etc.		
d. Intermediate Casing: Tools, Tongs, Operator, Crews, etc		
e. Production Casing: Tools, Tongs, Operator, Crews, etc.		10
f. Liner Casing: Tools, Tongs, Operator, Crews, etc.		
g. Mud Logger: _____ days at $_____/day.		
h. Wireline Work: Set BP, Storm Chokes, BPV, etc.		10
i. Tubing Make Up: Tongs, Crews, Computer, etc.		
j. Other: Lay down services.		10
Bridge plugs.		10
TOTAL	16	40
PROFESSIONAL SERVICES		
a. Consultant: Office Work		
b. Consultant: Wellsite Supervision		
Drilling: _____ days at $_____/day.		
Completion: 4 men 10 days at $ 875 /day.		9
c. Other 4 men x $50/day x 10 days living and travel		2
TOTAL	02	11
EQUIPMENT RENTAL		
a. Surface Equipment:		
Desilter _____ days at $_____/day.		
Centrifuge _____ days at $_____/day.		
Degasser _____ days at $_____/day.		
Shaker _____ days at $_____/day.		
Geolograph _____ days at $_____/day.		
Pit Level _____ days at $_____/day.		
Adj. Choke _____ days at $_____/day.		
Other 10 days at $ 200 /day.		2
b. Downhole Drilling Equipment (DP, DC, Stab, etc.)		
10 days at $ 300 /day.		3
c. Completion Equipments (BOP, Tubing tools, etc.)		
10 days at $ 300 /day.		3
d. Other		
TOTAL	15	8
ELECTRIC LOGGING & PERFORATING		
a. Log Type _____ Interval _____		
b. Log Type _____ Interval _____		
c. Log Type _____ Interval _____		
d. Log Type _____ Interval _____		
e. Cement Bond		
f. GR/Correlation		
g. Set WL Packers		
h. Perf		
i. Perf		
j. Other		
TOTAL	14	
CORING SERVICE & ANALYSIS		
a. Conventional Core 3rd Party Charges		
b. SWC: No. _____ Cores at $_____/Core.		
c. Core Analysis		
d. Other		
R TOTAL	14	

COST ESTIMATE: WELL: CROWN ZELLERBACH #2
P & A TEST WELL

	Accounting Code	
WELL STIMULATION SERVICES		
a. Swab Unit: _____ days at $_____/day.		
b. Nitrogen Service		
c. Acidize		
d. Acidize		
e. Acidize		
f. Frac		
g. Frac		
h. Other		
TOTAL	14	
TESTING SERVICES		
a. DST: No _____ at $_____/Test.		
b. Wireline FT Tests: No _____ at $_____/Test.		
c. Production Test Equipment & Service		
d. Casing Inspection		
e. Tubing Inspection		
f. Tubing Pressure Testing		
g. Other		
TOTAL	16	
DIRECTIONAL DRILLING EXPENSE		
a. Directional Tools & Services: _____ days at $_____/day		
b. Directional Surveys		
c. Other		
TOTAL	16	
TRANSPORTATION		
a. $500/day		5
b. Haul equipment to storage		10
c.		
d.		
TOTAL	17	15
SALARIED PERSONNEL		
a. Overhead and G & A		
b.		
c.		
TOTAL	12	
FUEL, POWER, WATER		
a. Fuel: $1000/day	12	10
b. Water: $100/day	12	1
c. Power: $50/day	12	1
d. Other: Living facilities, telephones	18	3
TOTAL		15
OTHER INTANGIBLE EXPENSES		
a. Operator Fee	21	-0-
b. Landowner Fee	21	-0-
c. Insurance	19	-0-
d. Unanticipated Costs		35
S TOTAL		35

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2

P & A TEST WELL

	Accounting Code	
CASING, LINERS, SETTING SERVICES		
a. Drive Pipe:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
b. Surface Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
c. Intermediate Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
d. Production Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
e. Liner Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
f. Other_____		
_____		
TOTAL	11	
TUBING		
a. Tubing Strings Required: _____		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____# ____Gr____Thd $_____/Ft.		
b. Internal Coating:_____		
c. Other_____		
_____		
TOTAL	11	
DOWNHOLE EQUIPMENT		
a. Packers_____		
b. Nipples_____		
c. Flow Cplgs._____		
d. Blast Joints_____		
e. Other Cement retainers_____		10
_____		
TOTAL	11	10
WELLHEAD EQUIPMENT		
a. Bradenhead: (___in____WP BTM) (___in____WP TOP)		
b. Casinghead: (___in____WP BTM) (___in____WP TOP)		
c. Casinghead: (___in____WP BTM) (___in____WP TOP)		
d. Tubinghead: (___in____WP BTM) (___in____WP TOP)		
e. Casing & Tubing Hangers_____		
f. Xmas Tree: Single_____ Dual_____ Triple_____		
No. _____ Valves with _____ WP _____		
g. Other_____		
_____		
TOTAL	11	
SUBTOTAL		324,000

T

EATON OPERATING COMPANY, INC.
DETAILED COST ESTIMATE

LEASE & WELL CROWN ZELLERBACH #1 | DATE 2/5/81 | BY RM
PROSPECT WOO TEST WELL | WILDCAT X | DEVELOPMENT
LOCATION LIVINGSTON PARISH, LA | LAND X | WATER
FIELD | T.D. | COMPL ZONES One

ESTIMATE COST TO PLUG AND ABANDON DISPOSAL WELL
(One Page)

	Accounting Code	Completed Well Cost
DRILLING EXPENSE		
a. Move In & Move Out		
b. Footage: ft. at $ /Ft.		
c. Drilling DW w DP: days at $ /day.		
d. Drilling DW wo DP: days at $ /day.		
e. Testing DW w DP: days at $ /day.		
f. Testing DW w days at $ /day.		
g. Completion DW w DP: days at $ /day.		
h. Completion DW wo DP: days at $ /day.		
i. Completion Rig days at $ /day.		
j. Other		
TOTAL	10	
LOCATION EXPENSE		
a. Permits		
b. Surveyor		
c. Build Road & Locn		
d. Dredging		
e. Damages		
f. Clean Up		50
g. Other		
TOTAL	09	50
MUD & COMPLETION FLUID EXPENSE		
a. Mud, Chemicals, Oil		
b. Mud Engineer days at $ /day.		
c. Completion Fluid		
d. Other		
TOTAL	12	
BITS - DRILLING & COMPLETION		
a. No. - Size at $ each.		
b. No. - Size at $ each.		
c. No. - Size at $ each.		
d. No. - Size at $ each.		
e. No. - Size at $ each.		
f. Other		
TOTAL	12	

CEMENTING SERVICE & EQUIPMENT

	Cement	Service	Float Eq.	Cent & Scratch	
a. Cond.					
b. Surf					
c. Inter					
d. Prod.					
e. Liner					
f. Other					
g. Squeeze Work					
h. P&A Charges					
i. Other Plug back cement					10
TOTAL					10
				SUBTOTAL	60

U

EATON OPERATING COMPANY, INC.
DETAILED COST ESTIMATE

LEASE & WELL CROWN ZELLERBACH NO. 2 | DATE 2/6/81 | BY RM
PROSPECT WOO TEST WELL | WILDCAT X | DEVELOPMENT
LOCATION LIVINGSTON PARISH | LAND X | WATER
FIELD | T.D. 17,000 | COMPL. ZONES

ESTIMATED COST TO PLUG AND TEST OPTIONAL ZONE
(6 Pages)

	Accounting Code	Completed Well Cost
DRILLING EXPENSE		
a. Move In & Move Out		10
b. Footage: ft. at $ /Ft.		
c. Drilling DW w DP: days at $ /day.		
d. Drilling DW wo DP: days at $ /day.		
e. Testing DW w DP: days at $ /day.		
f. Testing DW w days at $ /day.		
g. Completion DW w DP: days at $ /day.		
h. Completion DW wo DP: days at $ /day.		
i. Completion Rig 10 days at $ 6000 /day.		60
j. Other		
TOTAL	10	70
LOCATION EXPENSE		
a. Permits		
b. Surveyor		
c. Build Road & Locn Board Rental		5
d. Dredging		
e. Damages		
f. Clean Up		10
g. Other		
TOTAL	09	15
MUD & COMPLETION FLUID EXPENSE		
a. Mud, Chemicals, Oil		20
b. Mud Engineer days at $ /day.		
c. Completion Fluid		
d. Other		
TOTAL	12	20
BITS - DRILLING & COMPLETION		
a. No. - Size at $ each.		
b. No. - Size at $ each.		
c. No. - Size at $ each.		
d. No. - Size at $ each.		
e. No. - Size at $ each.		
f. Other		
TOTAL	12	

CEMENTING SERVICE & EQUIPMENT

	Cement	Service	Float Eq.	Cent & Scratch	
a. Cond.					
b. Surf					
c. Inter					
d. Prod.					
e. Liner					
f. Other					
g. Squeeze Work					
h. P&A Charges: Spot plug					25
i. Other					
TOTAL					25

V

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
OPTIONAL TEST WORK

		Accounting Code	
CONTRACT SERVICES			
a.	Drive Pipe: Hammer, Operator, Welder, etc.		
b.	Conductor Casing: Tools, Tongs, Operator, Crews, etc.		
c.	Surface Casing: Tools, Tongs, Operator, Crews, etc.		
d.	Intermediate Casing: Tools, Tongs, Operator, Crews, etc		
e.	Production Casing: Tools, Tongs, Operator, Crews, etc.		
f.	Liner Casing: Tools, Tongs, Operator, Crews, etc.		
g.	Mud Logger: ____ days at $____/day.		
h.	Wireline Work: Set BP, Storm Chokes, BPV, etc.		10
i.	Tubing Make Up: Tongs, Crews, Computer, etc.		
j.	Other:		
	TOTAL	16	10
PROFESSIONAL SERVICES			
a.	Consultant: Office Work		
b.	Consultant: Wellsite Supervision		
	Drilling: ____ days at $____/day.		
	Completion: 4 men 10 days at $ 875 /day.		9
c.	Other 4 men x $50/day x 10 days living and travel		2
	TOTAL	02	11
EQUIPMENT RENTAL			
a.	Surface Equipment:		
	Desilter ____ days at $____/day.		
	Centrifuge ____ days at $____/day.		
	Degasser ____ days at $____/day.		
	Shaker ____ days at $____/day.		
	Geolograph ____ days at $____/day.		
	Pit Level ____ days at $____/day.		
	Adj. Choke ____ days at $____/day.		
	Other 10 days at $ 200 /day.		2
b.	Downhole Drilling Equipment (DP, DC, Stab, etc.) 10 days at $ 300 /day.		3
c.	Completion Equipments(BOP, Tubing tools, etc.) 10 days at $ 300 /day.		3
d.	Other		
	TOTAL	15	8
ELECTRIC LOGGING & PERFORATING			
a.	Log Type ____ Interval ____		
b.	Log Type ____ Interval ____		
c.	Log Type ____ Interval ____		
d.	Log Type ____ Interval ____		
e.	Cement Bond		
f.	GR/Correlation		
g.	Set WL Packers		
h.	Perf		50
i.	Perf		
j.	Other		50
	TOTAL	14	100
CORING SERVICE & ANALYSIS			
a.	Conventional Core 3rd Party Charges		
b.	SWC: No. ____ Cores at $____/Core.		
c.	Core Analysis		
d.	Other		
	TOTAL	14	

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
OPTIONAL TEST WORK

		Accounting Code	
WELL STIMULATION SERVICES			
a.	Swab Unit: _____ days at $_____/day.		
b.	Nitrogen Service		
c.	Acidize		
d.	Acidize		
e.	Acidize		
f.	Frac		
g.	Frac		
h.	Other		
	TOTAL	14	
TESTING SERVICES			
a.	DST: No _____ at $_____/Test.		
b.	Wireline FT Tests: No _____ at $_____/Test.		
c.	Production Test Equipment & Service		
d.	Casing Inspection		
e.	Tubing Inspection		
f.	Tubing Pressure Testing		
g.	Other		
	TOTAL	16	
DIRECTIONAL DRILLING EXPENSE			
a.	Directional Tools & Services: _____ days at $_____/day		
b.	Directional Surveys		
c.	Other		
	TOTAL	16	
TRANSPORTATION			
a.	500/day		5
b.	Haul to storage		10
c.			
d.			
	TOTAL	17	15
SALARIED PERSONNEL			
a.			
b.			
c.			
	TOTAL	12	
FUEL, POWER, WATER			
a.	Fuel: 1000/day	12	10
b.	Water: 100/day	12	1
c.	Power: 50/day	12	1
d.	Other: Living facilities, telephone	18	3
	TOTAL		15
OTHER INTANGIBLE EXPENSES			
a.	Operator Fee	21	-0-
b.	Landowner Fee	21	-0-
c.	Insurance	19	-0-
d.	Unanticipated Costs		19
X	TOTAL		19

COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2

OPTIONAL TEST WORK

CASING, LINERS, SETTING SERVICES	Accounting Code	
a. Drive Pipe:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
b. Surface Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
c. Intermediate Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
d. Production Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
e. Liner Casing:		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
_____Ft. ____OD ____# ____Gr____Thd $_____/Ft.		
f. Other_____		
_____		
TOTAL	11	

TUBING		
a. Tubing Strings Required: _____		
_____ Ft. ____OD____#____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____#____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____#____Gr____Thd $_____/Ft.		
_____ Ft. ____OD____#____Gr____Thd $_____/Ft.		
b. Internal Coating:_____		
c. Other_____		
_____		
TOTAL	11	

DOWNHOLE EQUIPMENT		
a. Packers Cement Retainer		5
b. Nipples_____		
c. Flow Cplgs._____		
d. Blast Joints_____		
e. Other_____		
_____		
TOTAL	11	5

WELLHEAD EQUIPMENT		
a. Bradenhead: (___in____WP BTM) (___in____WP TOP)		
b. Casinghead: (___in____WP BTM) (___in____WP TOP)		
c. Casinghead: (___in____WP BTM) (___in____WP TOP)		
d. Tubinghead: (___in____WP BTM) (___in____WP TOP)		
e. Casing & Tubing Hangers_____		
f. Xmas Tree: Single_____ Dual_____ Triple_____		
No. _____ Valves with _____ WP _____		
g. Other_____		
_____		
TOTAL	11	
SUBTOTAL		263,000

Y

TESTING COST ESTIMATE: WELL: CROWN ZELLERBACH NO. 2
OPTIONAL TEST

		Accounting Code	
SURFACE EQUIPMENT & PRESSURE VESSELS			
a. Separators:	DOE Equipment		-
b. Tanks:	2 100 bbl calibration tanks @ 40		1
c. Filters:	Back flushing filter @ 300		7
d. Meters:	4 HOWCO LCD Readouts @ 60		2
e. Pumps:	Meter calibration pump @ $150		4
f. Compressors:	Instrument air supply @ 35		1
g. Dead Weight Tester:	Manifold @35		1
h. Scrubbers:			
i. Dehydrators:			
j. Gas Coolers:			
k. Water Coolers:			
TOTAL		24	16
PIPING, FITTINGS, FLANGES			
a.	Pit lines @ $480		10
b.	Casing kill line @100		2
c.	Tubing kill line @ 100		2
d.	Flange @20		1
e.			
f.			
TOTAL		24	15
FOUNDATIONS			
a.	Roustabout crews		10
b.	Board Road Upkeep and Rental		25
c.	Other location costs		5
d.			
e.			
TOTAL		24	40
WIRELINE SERVICE			
a.	Gearheart Industries BH Sampling		10
b.	Wireline BHP Recording @ 3100/day		70
c.			
TOTAL		24	80
CHEMICAL INHIBITOR COSTS			
a.	Scale chemical		3
b.	Corrosion chemical		3
c.	Service cost		5
TOTAL		12	11
LABOR			
a.	Supervisor @ 840/day		18
b.	4 Testers @ 1680/day		36
c.	Subsistance @ 25 each		3
TOTAL		24	57

Z

TESTING COST ESTIMATE: WELL: CROWN ZELLERBACH #2
OPTIONAL TESTING

	Accounting Code	
LIGHTING, POWER, LIVING FACILITIES		
a. Living quarters, telephone, etc.		10
b. Power and lights		10
c. Water		3
TOTAL	18	23
TRANSPORTATION		
a. 500/day		11
b. Extra hauling		10
TOTAL	17	21
SUPERVISION		
a. 3 men @ 660/day		13
b. 3 men @ 150/day subsistance		3
TOTAL	02	16
CONTRACT SAMPLING & ANALYSIS IGT	24	80
OTHER TESTING COSTS		
a. H_2S safety equipment @ 860/day		18
b. 440 bbl mud kill system @ 800/day		17
c. Disposal pump and 220 bbl tank @ 250/day		6
d. Flow line bypass choke at 105		2
e. Pilot light for flare @ 30		1
f. SWACO choke for casing at 20		1
g. Sand derector @ 70		2
h.		
i.		
j.		
k.		
l.		
m.		
TOTAL	24	47
OUTSIDE CONSULTANTS	20	5
UNANTICIPATED TESTING COSTS		41
EOC FIXED FEES		-0-
SUBTOTAL		452
GRAND TOTAL FOR OPTIONAL TEST		715,000

AA

15.0 OPTION TO TEST ADDITIONAL SAND

After testing of the zone from 16,718 feet to 16,754 feet is completed and upon approval of all concerned parties, the well could be plugged back to a second zone and tested through perforations 16,462 feet to 16,490 feet.

15.1 Plug Back Procedure

A workover rig will have to be moved on location to perform the plug back. The well should be killed with 13.8 ppg oil based mud prior to moving in the rig. The workover procedure for the plug back follows:

Day No.	Procedure
1	Finish moving in rig and rigging up.
2	Nipple down christmas tree and nipple up blowout preventer. Test blowout preventers according to EOC specifications.
3	Pull out of hole with tubing.
4	Go in hole with cement retainer on tubing and set it at 16,650 feet. Squeeze perforations 16,718 feet to 16,754 feet with 200 sacks of cement and spot 100 feet cement plug on top of retainer.
5	Pull out of hole with tubing and install wireline guide on tubing. Go in hole with tubing.
6	Displace 13.8 ppg mud with 9.0 ppg saltwater. Pull tubing up to 16,350 feet.

Day No.	Procedure
7	Nipple down blowout preventers and nipple up christmas tree.
8	Pressure test casing and christmas tree to 6,000 psi. Rig down equipment and move out rig.
9	After rig has moved out, perforate well from 16,462 feet to 16,490 feet with 1-11/16 inch hollow carrier gun, 8 holes per foot. Pressure casing up to 4,000 psi prior to first perforating job.

15.2 Testing of Second Zone

The surface production and test facilities and the well test procedure are expected to be similar to the test on the first zone. Reference is made to Sections 10.0 and 11.0 in this book for test facilities and procedures.

Plug back and testing costs are shown in Tables 15-1 and 15-2, respectively.

TABLE 15-1

ESTIMATED COST TO COMPLETE

OPTIONAL SAND

MARTIN-CROWN ZELLERBACH WELL NO. 2

Accounting Code	Item	Original Estimate
02	Field Labor	$ 12,000
09	Site	16,000
10	Drilling	75,000
11	Tangible	6,000
12	Expendables	34,000
13	Cementing	27,000
14	Perf., Acid	54,000
15	Equip. Rental	9,000
16	Contract Service	10,000
17	Freight & Trans.	16,000
18	Other	3,000
19	Insurance	-0-
20	Consultants	-0-
21	Land Use	-0-
24	Testing	-0-
	TOTAL	$ 263,000

TABLE 15-2

ESTIMATED COST TO PERFORM OPTIONAL

GEOPRESSURED-GEOTHERMAL TEST

MARTIN-CROWN ZELLERBACH WELL NO. 2

Accounting Code	Item	Original Estimate
02	Field Labor	$ 18,000
09	Site	-0-
10	Drilling	-0-
11	Tangible	-0-
12	Expendables	12,000
13	Cementing	-0-
14	Perf., Acid	-0-
15	Equip. Rental	-0-
16	Contract Serv.	-0-
17	Freight & Trans.	23,000
18	Other	25,000
19	Insurance	-0-
20	Consultants	5,000
21	Land Use	-0-
24	Testing	369,000
	TOTAL	$ 452,000

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3100 Edloe
Houston, Texas 77027
(713) 627-9764

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST

GEOPRESSURED-GEOTHERMAL WELL TEST PROGRAM

WELL Martin Crown Zellerbach Well No. 2

LOCATION Livingston Parish, La.

A. GENERAL

1. Is the proposed site located in the area covered by the "Gulf Coast Programmatic Environmental Assessment, Geothermal Well Testing, the Frio Formation of Texas and Louisiana, "October 1977? Yes X No ____ If no, explain.

2. Has a Federal, state and/or local environmental assessment been conducted previously for the proposed test well or other wells in the area? Yes ____ No X If yes, provide a copy, if available.

3. Have all required permits, licenses, and/or agreements for proposed project been obtained? Yes ____ No X If no, explain.
Still applying for permits, etc.

4. Does the project site fall within the habitat of rare or endangered species? Yes ____ No X If yes, explain.

5. Are known archeological sites, historic sites, or natural landmarks within or visible from the site area? Yes ____ No X
If yes, explain.

6. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence?
Yes X No ____ If no, explain.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the test well (e.g., drill pad, road construction, mud reserve pits, pipeline)?

Yes ____ No X If yes, describe.

2. Will additional land clearing be required for the disposal well (e.g., drill pad, reserve pits, utilities, road construction, pipeline)?

Yes ____ No X If yes, describe.

3. Will the site and related roads be treated to minimize dust?

Yes ____ No X If no, explain.
Location will be covered by boards. No residence within one-half mile.

4. Are portable sanitary facilities or an approved septic system to be used at the site? Yes X No ____ If no, explain.

5. Will liquid and solid wastes be disposed in accordance with local regulations? Yes X No ____ If no, explain.

6. Will erosion control be required for excavated areas?

Yes ____ No X If yes, explain.

7. Will dredge spoil be deposited in swamp forest or marshland?

Yes ____ No X If yes, explain.

8. Upon completion of proposed test program, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding? Yes X No ____ If no, explain.

C. WELL TESTING AND SAFETY

1. Is fluid production from the well during testing expected to be 2 weeks or less in duration per formation? Yes X No ____ If no, explain.

2. Is the total dissolved solids of the produced geopressure fluid expected to be 90,000 mg/l or less? Yes X No ____ If no, explain.

3. Is the volume of geopressure fluid to be produced and injected expected to be 300,000 barrels or less? Yes X No ____ If no, explain.

4. Is the temperature of produced geopressured fluid expected to be 260° C or less? Yes X No ____ If no, explain.

5. Will the gas content of the produced fluid be flared? Yes X No ____ If no, explain.

6. Will blowout preventers rated to at least 10,000 psi be used? Yes ____ No X If no, explain.

Surface pressures are not expected to be over 5,000 PSI. BOP'S with a 5,000 PSI W.P. rating are planned.

7. Will production tubing rated to at least 20,000 psi, be used?

Yes ____ No X If no, explain. Tubing will be hung open ended. Pressures should not exceed 5,000 PSI.

8. Can safety valves be operated from remote locations?

Yes X No ____ If no, explain.

9. Will the test tree be rated to at least 10,000 psi?

Yes X No ____ If no, explain.

10. Will a test well directional survey be conducted? Yes ____ No X

If yes, at what interval? _____, If no, explain. Test well was drilled as dry hole and is being tested under DOE wells of opportunity program.

11. Will a lined pond be used to hold all liquid effluents and production fluids that are not injected? Yes ____ No X If no, explain. Not required by state.

12. Has an injection permit been obtained? Yes ____ No X If no, explain. Not filed for yet.

13. Will H_2S monitors be located on site? Yes X No ____ If no, explain.

14. Will fire extinguishers be located on site? Yes X No ____

If no, explain.

15. Do contingency plans exist for evacuating personnel should a blowout occur or high levels of H_2S be detected? Yes X No ____

If no, explain.

16. Will high-pressure engineering and mud logging personnel be on site during production will drilling operations? Yes ____ No X

If no, explain. No drilling to occur during completion operations.

EXHIBIT A

H_2S SAFETY PROGRAM AND EMERGENCY EVACUATION PLAN

EATON OPERATING COMPANY, INC.

MARTIN CROWN ZELLERBACH WELL NO. 2

LIVINGSTON PARISH, LOUISIANA

Eaton Industries of Houston, Inc.
Eaton Operating Co., Inc.
3100 Edloe
Houston, Texas 77027
(713) 627-9764

DOE CONTRACT NO.
DE-AC08-80ET-27081

PURPOSE

The purpose of this section is to provide guidelines for procedures to be followed during the workover and testing operations on subject well which is known to have concentrations of up to 50 PPM hydrogen sulfide bearing gas. The inherent danger associated with the toxic hydrogen sulfide gas requires additional, more stringent, safety guidelines to be in effect during the operations.

All personnel working at the well site will be required to familiarize themselves with these general guidelines, and be prepared in the event an emergency condition develops. Emergency conditions developing during operations will require immediate action. The guidelines in this booklet are not designed to supplant judgment decisions by operating personnel during emergency conditions.

SAFETY PROGRAM

FOR OPERATIONS WITH SOUR GAS

I. Location of Equipment

A. Drilling Equipment: The following criteria must be achieved:

1. The drilling rig is to be situated on location so that the prevailing winds blow across the rig and toward the reserve pit.
2. The location will be of sufficient size to accomplish each job safely, i.e., large reserve pit, ample pipe rack and turn-around, etc.
3. Cleared areas will be designated by a pennant and located in such a manner that one area will always be upwind. During any emergency, personnel will assemble in the "upwind area" for instructions from the Eaton Foreman.
4. Two (2) wind socks with streamers will be located to indicate current wind directions.
5. All areas will be illuminated at night.
6. A list of the current emergency telephone numbers will be located on the rig bulletin board, the Eaton Foreman's trailer, and the emergency equipment (EE) trailer.
7. An automatic hydrogen sulfide (H_2S) monitor will be provided. The H_2S monitor alarm system will be tested daily at 7 A.M. The H_2S detectors should be tested daily or as conditions warrant.

8. Two "bug blowers" with explosion proof motors will be positioned:
   a. One on the rig floor to blow fumes downwind.
   b. One under the rig floor to clear gas from substructure.
9. The mud tanks are to be 45 feet or more from the well bore to minimize the danger from any gas breaking out of the mud. The mud tanks will be equipped with a vacuum degasser.
10. The rig electric power plant will be separated from the rig structure so that it may be used under conditions where it otherwise would be shut down.
11. Each site will be equipped with a commercial telephone (if available).
12. The emergency equipment to be located at the emergency equipment (EE) trailer is shown in Table A-2
13. Equipment to be located on rig floor.
   a. Bottle rack for refilling hip pack, air hose to driller and to monkey board.
   b. Hip pack on monkey board at all times.
   c. Hip packs will be available for driller and rig crew.
   d. One stokes litter.
   e. One portable H_2S detector.

II. Drilling and Testing Guidelines

A. Blowout Prevention Equipment

1. When drilling, the minimum blowout prevention equipment will be two ram BOP's and 1 bag type.
2. All BOP equipment and choke manifolds must be designed for sour service.
3. Whenever possible, Grade "B" seamless line pipe of proper pressure ratings will be used for all surface lines that may carry fluids containing H_2S. If it is necessary to use pipe other than Grade "B" seamless, it must be hardness tested to have a Rockwell C (R_c) value of 22 or less.
4. A 4" - 5000 psi line will be installed as straight as possible from the choke manifold to the burn pit.
5. The BOP and choke manifold will be pressure tested according to Eaton testing procedures.
6. The BOP will be operationally tested every 24 hours.

B. Safety

Every person who will be at the location in any capacity will be required to be familiar with emergency procedures and to participate in training program. This includes Company personnel, rig personnel and service company personnel. New employees must be immediately trained in the use of protective equipment and techniques for combating H_2S. Keep untrained personnel and personnel

with perforated eardrums off location. A safety meeting will be conducted a minimum of once per week per tour in which the following will be taught:

1. Explanation of seriousness of H_2S problem.
2. Explanation of prevailing winds, importance of ventilation, use of windsock and wind streamers, blowers and fans, movement upwind, and evacuation routes.
3. Use care in servicing of:
   a. Protective breathing equipment (air-paks, escape air bottles, and hose line).
   b. Portable H_2S detection instruments.
   c. SO_2 detection instruments.
   d. Explosimeter.
   e. Resuscitation equipment.
   f. Portable fire extinguishers.
   g. Alarm indicators.
4. Mouth-to-mouth resuscitation and the following first aid procedure if a person is overcome by hydrogen sulfide:
   a. Wear masks if rescuing person in contaminated area.
   b. Immediately move person to fresh air and if not breathing, give mouth-to-mouth resuscitation.
   c. At first opportunity, replace mouth-to-mouth resuscitation with resuscitator.

d. Continue to administer oxygen when person begins breathing.

e. Treat for shock.

f. Get doctor and ambulance.

5. Explanation that before entering area suspected of being contaminated with H_2S, a test should be made.

6. Explanation that personnel should watch out for each other. Where possible, they should work in pairs. Require use of this "buddy system" to prevent anyone from entering a gas area alone.

7. Explanation to never enter an enclosed place where H_2S may have accumulated without wearing protective breathing equipment. If the worker if over an arm's length away, a safety belt should be secured to a life line and held by a responsible person in the clear. Do not remove mask after being in an enclosed area which contains H_2S until absolutely certain air is safe to breathe.

8. Explanation of the effects of H_2S on metal.

9. Emergency instructions in event of sudden gas release without warning to:

a. Hold breath.

b. Put on mask.

c. Help anyone in distress.

d. Evacuate to a protected area and follow instructions of supervisor.

e. Do not panic.

10. Unannounced "blowout" drills will be held at the discretion of the Eaton Foreman. "Gas Discipline" will be maintained. When the "masks on" period exists, there will be no exceptions.

C. Igniting the Well

In the event of a blowout, the decision to ignite the well is the responsibility of the drilling foreman. However, the decision should be made only as a last resort and in a situation where it is clear that:

1. Human life and property are endangered.
2. There is no hope of controlling the blowout under the prevailing conditions of the well.

In all cases an attempt should be made to notify the Houston office of the plans to ignite the well, if time permits. However, the foreman must not delay his decision if human life is threatened. REMEMBER, if the well is ignited, the burning H_2S will be converted to sulfur dioxide (SO_2) which is also highly toxic. Do not assume that the area is safe after the well is ignited. Follow through with all plans to evacuate endangered persons. The following steps will be taken to ignite the well:

1. In preparation of igniting the well, keep all unnecessary persons in "upwind assembly area". Two people are required for the actual ignition. Both men will wear self-contained breathing units and will have 400 feet retrieval ropes tied around their waists. One man is responsible for checking the atmosphere for explosive gases with explosimeter. The other man is responsible for igniting the well. Persons remaining in "assembly area" will closely watch the ignition team; and should either man be overcome by fumes, they will immediately pull him to safety by the retrieval ropes.
2. Always ignite the well from upwind and do not approach well any closer than warranted.
3. Remember, before firing flare gun or igniting flammable material, check the atmosphere at your location for combustible gases with explosimeter.

HYDROGEN SULFIDE TOXICITY

1. 10 ppm, maximum concentration for 8-hour exposure with no adverse effect.
2. 50-100 ppm, 1-hour exposure will produce subacute poison symptons (mild conjunctivitis and respiratory tract irritation).
3. 100-200 ppm, coughing, eye irritation, loss of smell, pain in eyes, drowsiness and throat irritation.
4. 200-700 ppm, 1-hour exposure will produce marked poison symptoms.
5. 700-2000 ppm, produces acute poison, ranging from rapid unconsciousness and cessation of respiration to death in a few minutes at the higher concentrations.
6. 5000 ppm - fatal.
7. 10 ppm can be detected by smell.
8. 100 ppm may produce impairment and temporary loss of the sense of smell in 3 to 15 minutes.

Poison symptoms:

a. Burning of eyes, nose and throat.

b. Coughing.

c. Conjunctivitis (inflammation of mucous membrane under eyelids).

d. Gastritis (inflammation of mucous membrane of stomach).

e. Dyspnea (difficult or labored breathing).

f. Dumbness - not having the usual accompanient of speech and sound.

g. Slow pulse.

h. Headache.

i. Perspiration.

j. Contracted pupils.

k. Convulsions (abnormal violent and involuntary contraction of muscles).

l. Paralysis.

m. Unconsciousness.

TABLE A-1

DEFINITION OF OPERATING CONDITIONS

Three operating "conditions" are defined as:

Condition I - No danger to human life

Characterized by:

1. Drilling or completion operations are normal.
2. No drilling breaks, kicks, gas cut mud; etc. have occurred to indicate that formation fluids may have entered the well bore.
3. Hydrogen sulfide (H_2S) concentration at any of the H_2S monitors is indicated to be 5 ppm or less.

General Action:

1. Periodically check safety equipment (gas masks, air tanks, H_2S detectors, etc.) to ensure proper functioning.
2. Be alert for any changes in drilling and completion conditions which may indicate intrusion of formation fluids.

Condition II - Potential danger to life

Characterized by:

1. Poisonous gas present near the threshold concentration (H_2S: 5-10 ppm) (SO_2: 5 ppm).
2. Drilling break, well kick, gas cut mud, etc., have occurred to indicate that formation fluids may have entered the well bore.

3. Very minor poisonous gas leaks from valves, flanges, equipment, etc.

4. When pulling a conventional core out of the hole.

General Action:

1. Air tanks with gas masks attached should be worn or placed in an area so that they are readily accessible. Do not wear face mask at this time.

2. Check all gas masks, air bottles, lines and other safety equipment for proper operation.

3. Alert all crew members and service personnel to the proper assembly area.

4. Eaton foreman is to ensure upwind assembly area is properly designated.

Condition III - Danger to life

Characterized by either:

1. Poisonous gas concentration above safe limit.

   H_2S: 11 ppm or greater

   SO_2: 6 ppm or greater

2. Moderate gas leaks of poisonous gas (see above for concentrations) from valves, flanges, lines, etc.

General Action:

1. All personnel should begin using their self-contained breathing apparatus (gas masks).
2. The "buddy system" will immediately go into effect.
3. Personnel not essential to the operation should go to the safe assembly area.

In the event of complete loss of control of the well, the following will be in effect:

1. Stay in the "upwind or safe assembly area" if not working to control or correct the situation. (It may be necessary to evacuate these areas if noise or other hazards become excessive. Evacuation should proceed after notifying the person in charge, if possible).
2. Follow instructions of the foreman.
3. The foreman will ignite the well as outlined in section titled "Igniting the Well". Foreman will conduct any necessary operations with an absolute minimum of personnel. All persons working in the immediate hazard area will wear a self-contained breathing apparatus. All other personnel will restrict their movements to those directed by foreman.
4. If the well is ignited, the burning hydrogen sulfide (H_2S) will be converted to sulfur dioxide (SO_2) which is also poisonous. Therefore, DO NOT assume that the area is safe after the gas is ignited. Continue to observe emergency procedures and follow the instructions of the foreman.

General Emergency Action

In the event an emergency situation occurs without any prior warnings (e.g., sudden gas leaks, gas in mud, H_2S alarm sounds):

1. Hold your breath.
2. Evacuate quickly to the "upwind assembly area" (Driller - If time permits, stop motion of rig.).
3. DO NOT PANIC.

With prior warning of presence of poisonous gases, Condition II will be in effect; therefore, if the situation suddenly worsens (e.g., increase in gas leaks, high gas cut from mud, or H_2S alarm is sounded by the monitoring operator):

1. Hold your breath.
2. Put on gas masks.
3. Driller - Secure rig.
   a. Stop motion of rig.
   b. Close blowout preventers if necessary.
4. Help anyone who may be affected by gas.
5. Evacuate quickly to the "upwind assembly area".
6. DO NOT PANIC.

The foreman will assess the situation and assign duties to various persons to bring the situation under control. Follow his instructions; the success of this plan depends on your cooperation. When the severity of the situation has been determined, all persons will be advised.

TABLE A-2

EMERGENCY EQUIPMENT (TRAILER INVENTORY)

ITEM	QUANTITY	DESCRIPTION
1	4	6 PDK Racks (Total 24) 300 ft.^{3} Comp. Air Cylinders with Cascade Manifold
2	1-250'	Stainless Steel Line
3	8-50'	Hose Lines
4	3	Outlets
5	1	Refill Hose
6	1	4 Channel H_2S Gas Detector w/Explosion Proof Lights and Siren
7	12	H_2S Spot Check Pocket Detectors (Lead Acetate Tape)
8	2	Wind Socks with 2-110' Streamers
9	5	Survivair Self Contained Breathing Units (30 min. supply) Pressure Demand
10	8	10 Minute Escape Paks. Work Units with Hose Connector Attachments with Fiberglas Housings
11	2	H_2S (and Hyrdogen Sulfide) "Sniffer" Detectors (Bendix Type)
12	2	Warning Signs-"No Smoking Beyond This Point" "Restricted Keep Out, Hydrogen Sulfide Poisonous Gas"

EMERGENCY EQUIPMENT (TRAILER INVENTORY)

CONTINUED

ITEM	QUANTITY	DESCRIPTION
13	1	Explosimeter Plus Calibration Kit
14	2	Explosion Proof "Bug Blower" Fans

TABLE A-3

EMERGENCY TELEPHONE NUMBERS

EATON INDUSTRIES

	Telephone No.
Eaton Houston Office	(713) 627-9764
	Home Phone No.
J. E. Evans V.P. Operations	(713) 440-6490
R. Z. Klauzinski Chief Petroleum Engineer	(713) 444-4695
D. Garrett Test Manager	(713) 376-1586
D. A. Langford Deputy Project Manager - DOE Project	(713) 376-1681
C. Featherston V.P. Engineering	(713) 440-8564
Livingston Co. Sheriff	(504) 686-2241
Dixon Memorial Hospital	(504) 665-8211