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CH2MHILL

October 10, 2008

371322

DOCKET
08-AFC-10
DATE OCT 10 2008
RECD. OCT 10 2008

Rod Jones
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Lodi Energy Center (08-AFC-10)
Supplement A – Class 1 Underground Injection Control Well Permit Application

Dear Mr. Jones:

Please find attached the Lodi Energy Center's Supplement A – Class I Underground Injection Control Well Permit Application. This supplement is being submitted as an addendum to the Lodi Energy Center Application for Certification (08-AFC-10), submitted on September 10, 2008.

Due to the size of the document 5 hard copies and three electronic copies on CD-ROM have been provided. Additional electronic copies will be provided upon request.

If you have any questions about this matter, please contact me at (916) 286-0249 or Andrea Grenier at (916) 780-1171.

Sincerely,

CH2M HILL

Sarah Madams
AFC Project Manager

Attachment

cc: A. Grenier, Grenier & Associates, Inc.
E. Warner, NCPA

Class 1 Underground Injection Control Well Permit Application

NCPA STIG-1, LEC-1, and LEC-2 Wells for the Lodi Power Facilities

Submitted by

Northern California Power Agency

Submitted to

U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco CA 94105-3901

October 2008

A PUBLIC AGENCY
NCPA
NORTHERN CALIFORNIA POWER AGENCY

651 Commerce Drive
Roseville, CA 95678

(916) 781-3636

www.ncpa.com

October 10, 2008

Adam Freedman
U.S. Environment Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

Subject: Permit Application for Class 1 Underground Injection Well

Dear Mr. Freedman:

Enclosed is the Northern California Power Agency (NCPA) Underground Injection Control Permit Application for the STIG-LEC facility. This permit application serves as the re-application for the existing steam injected gas turbine (STIG)-1 injection well. It also is the application for the Lodi Energy Center (LEC)-1 injection well to support the LEC. Construction of the LEC is planned to begin in first quarter 2010. In addition, a third injection well (LEC-2) is included in the application. It may be drilled in the future to serve as the backup well to both the existing STIG-1 well and the new LEC-1 well. The existing and proposed injection wells are defined as Class 1 wells under Title 40 Code of Federal Regulations (40 CFR) Subsection 144.5.

Fluid injection at the STIG-LEC facility would be at a maximum rate of 425 gallons per minute (gpm). The existing STIG-1 well currently is permitted to inject up to 200 gpm, which is the same rate assumed in the re-application. The proposed injection rate of the LEC-1 well is 225 gpm. LEC-2, the proposed backup well, would not operate at a rate higher than 225 gpm and would serve as a backup well to either STIG-1 or LEC-1 at any given time, but would not back up both wells concurrently above a rate of 225 gpm. STIG-1 injects into the Domengine Formation at depths of between 4,234 and 4,507 feet, and the new wells would inject within the same zone.

The composition of the STIG-1 injectate is expected to remain between 400 and 1,000 mg/L total dissolved solids (TDS), as it has since the well began routine operation in 2000, unless it is backing up the LEC-1 well. The composition of the LEC-1 injectate is modeled to be about 2,186 mg/L TDS. TDS values within the Domengine Formation are approximately 14,000 TDS. No underground sources of drinking water are expected to be affected by the proposed injection operations at the STIG-LEC facility.

NCPA and its consultants, CH2M HILL and Worley-Parsons, look forward to working with the EPA in a manner that will result in a timely issuance of the permit. Our intention is to drill and test the LEC-1 in fourth quarter 2009, prior to initiating construction at the LEC.

Randall Blank, NCPA's Environmental Health and Safety Manager, is your point of contact for the completion of this permit. He can be reached at his office phone, (916) 781-4265, or cell phone, (209) 327-5397. If you have any further questions, please do not hesitate to call me at (209) 333-6370 x100 or Ed.Warner@ncpagen.com.

Sincerely,

10/10

Ed Warner
NCPA Project Manager

cc: Tim Kustic, California Department of Oil, Gas, & Geothermal Resources
Doug Patterson, Central Valley Regional Water Quality Control Board (Fresno)
Harlan Knoll, San Joaquin County Environmental Health Department

Class 1 Underground Injection Control Well Permit Application

NCPA STIG-1, LEC-1, and LEC-2 Wells for the Lodi Power Facilities

Submitted to

US Environmental Protection Agency

October 2008

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OMB No. 2040-0042 Approval Expires 4/30/07

United States Environmental Protection Agency

EPA

Underground Injection Control Permit Application

(Collected under the authority of the Safe Drinking Water Act. Sections 1421, 1422, 40 CFR 144)

I. EPA ID Number		T/A	C
U	100000160817		

Read Attached Instructions Before Starting

For Official Use Only

Application approved (mo day year)	Date received (mo day year)	Permit Number	Well ID	FINDS Number

II. Owner Name and Address			III. Operator Name and Address		
Owner Name: Northern California Power Agency (NCPA)			Owner Name: Northern California Power Agency (NCPA)		
Street Address: 12751 North Thorton Road		Phone Number: (209) 728-1387	Street Address: 651 Commerce Drive		Phone Number: (916) 781-3636
City: Lodi	State: CA	ZIP CODE: 95242	City: Roseville	State: CA	ZIP CODE: 95678

IV. Commercial Facility	V. Ownership	VI. Legal Contact	VII. SIC Codes
[ ] Yes [x] No	[ ] Private [ ] Federal [x] Other (Public)	[x] Owner [ ] Operator	4911

VIII. Well Status *(Mark "x")*

[x] A Operating	Date Started (mo day year): 12/08/1994	[ ] B. Modification/Conversion	[x] C. Proposed

IX. Type of Permit Requested *(Mark "x" and specify if required)*

[ ] A. Individual	[x] B. Area	Number of Existing Wells	Number of Proposed Wells	Name(s) of field(s) or project(s)
		1	2	STIG-LEC facility

X. Class and Type of Well *(see reverse)*

A. Class(es) (enter code(s))	B. Type(s) (enter code(s))	C. If class is "other" or type is code 'x,' explain	D. Number of wells per type (if area permit)
1	I		2 to 3 wells total, including one existing well

XI. Location of Well(s) or Approximate Center of Field or Project

Latitude Deg	Latitude Min	Latitude Sec	Longitude Deg	Longitude Min	Longitude Sec	Township and Range Sec	Twp	Range	1/4 Sec	Feet From	Line	Feet From	Line
38	05	16	-121	23	15	24	3N	5E	SW	200'	S	240'	W

XII. Indian Lands (Mark 'x')

[ ] Yes
[x] No

XIII. Attachments

(Complete the following questions on a separate sheet(s) and number accordingly; see instructions)

For Classes I, II, III, (and other classes) complete and submit on a separate sheet(s) Attachments A--U (pp 2-6) as appropriate. Attach maps where required. List attachments by letter which are applicable and are included with your application.

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possiblity of fine and imprisonment. (Ref. 40 CFR 144.32)

A. Name and Title *(Type or Print)*	B. Phone No. *(Area Code and No.)*
Ed Warner	(209) 333-6370
C. Signature: Ed Warner	D. Date Signed: 10/10/08

EPA Form 7520-6 (Rev. 8-01)

Well Class and Type Codes

Class I Wells used to inject waste below the deepest underground source of drinking water.

Type **"I"** Nonhazardous industrial disposal well
"M" Nonhazardous municipal disposal well
"W" Hazardous waste disposal well injecting below USDWs
"X" Other Class I wells (not included in Type "I," "M," or "W")

Class II Oil and gas production and storage related injection wells.

Type **"D"** Produced fluid disposal well
"R" Enhanced recovery well
"H" Hydrocarbon storage well (excluding natural gas)
"X" Other Class II wells (not included in Type "D," "R," or "H")

Class III Special process injection wells.

Type **"G"** Solution mining well
"S" Sulfur mining well by Frasch process
"U" Uranium mining well (excluding solution mining of conventional mines)
"X" Other Class III wells (not included in Type "G," "S," or "U")

Other Classes Wells not included in classes above.
Class V wells which may be permitted under §144.12.
Wells not currently classified as Class I, II, III, or V.

Attachments to Permit Application

Class	**Attachments**
I new well	A, B, C, D, F, H – S, U
existing	A, B, C, D, F, H – U
II new well	A, B, C, E, G, H, M, Q, R; optional – I, J, K, O, P, U
existing	A, E, G, H, M, Q, R, – U; optional – J, K, O, P, Q
III new well	A, B, C, D, F, H, I, J, K, M – S, U
existing	A, B, C, D, F, H, J, K, M – U
Other Classes	To be specified by the permitting authority

INSTRUCTIONS - Underground Injection Control (UIC) Permit Application

Paperwork Reduction Act: The public reporting and record keeping burden for this collection of information is estimated to average 394 hours for a Class I hazardous well application, 252 hours for a Class I non-hazardous well application, 32 hours for a Class II well application, and 119 hours for a Class III well application. Burden means the total time, effort, or financial resource expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal Agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to the collection of information; search data sources; complete and review the collection of information; and, transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques to Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW., Washington, DC 20460. Include the OMB control number in any correspondence. Do not send the completed forms to this address.

This form must be completed by all owners or operators of Class I, II, and III injection wells and others who may be directed to apply for permit by the Director.

I. **EPA I.D. NUMBER** - Fill in your EPA Identification Number. If you do not have a number, leave blank.

II. **OWNER NAME AND ADDRESS** - Name of well, well field or company and address.

III. **OPERATOR NAME AND ADDRESS** - Name and address of operator of well or well field.

IV. **COMMERCIAL FACILITY** - Mark the appropriate box to indicate the type of facility.

V. **OWNERSHIP** - Mark the appropriate box to indicate the type of ownership.

VI. **LEGAL CONTACT** - Mark the appropriate box.

VII. **SIC CODES** - List at least one and no more than four Standard Industrial Classification (SIC) Codes that best describe the nature of the business in order of priority.

VIII. **WELL STATUS** - Mark Box A if the well(s) were operating as injection wells on the effective date of the UIC Program for the State. Mark Box B if wells(s) existed on the effective date of the UIC Program for the State but were not utilized for injection. Box C should be marked if the application is for an underground injection project not constructed or not completed by the effective date of the UIC Program for the State.

IX. **TYPE OF PERMIT** - Mark "Individual" or "Area" to indicate the type of permit desired. Note that area permits are at the discretion of the Director and that wells covered by an area permit must be at one site, under the control of one person and do not inject hazardous waste. If an area permit is requested the number of wells to be included in the permit must be specified and the wells described and identified by location. If the area has a commonly used name, such as the "Jay Field," submit the name in the space provided. In the case of a project or field which crosses State lines, it may be possible to consider an area permit if EPA has jurisdiction in both States. Each such case will be considered individually, if the owner/operator elects to seek an area permit.

X. **CLASS AND TYPE OF WELL** - Enter in these two positions the Class and type of injection well for which a permit is requested. Use the most pertinent code selected from the list on the reverse side of the application. When selecting type X please explain in the space provided.

XI. **LOCATION OF WELL** - Enter the latitude and longitude of the existing or proposed well expressed in degrees, minutes, and seconds or the location by township, and range, and section, as required by 40 CFR Part 146. If an area permit is being requested, give the latitude and longitude of the approximate center of the area.

XII. **INDIAN LANDS** - Place an "X" in the box if any part of the facility is located on Indian lands.

XIII. **ATTACHMENTS** - Note that information requirements vary depending on the injection well class and status. Attachments for Class I, II, III are described on pages 4 and 5 of this document and listed by Class on page 2. Place EPA ID number in the upper right hand corner of each page of the Attachments.

XIV. **CERTIFICATION** - All permit applications (except Class II) must be signed by a responsible corporate officer for a corporation, by a general partner for a partnership, by the proprietor of a sole proprietorship, and by a principal executive or ranking elected official for a public agency. For Class II, the person described above should sign, or a representative duly authorized in writing.

INSTRUCTIONS - Attachments

Attachments to be submitted with permit application for Class I, II, III and other wells.

A. **AREA OF REVIEW METHODS** - Give the methods and, if appropriate, the calculations used to determine the size of the area of review (fixed radius or equation). The area of review shall be a fixed radius of 1/4 mile from the well bore unless the use of an equation is approved in advance by the Director.

B. **MAPS OF WELL/AREA AND AREA OF REVIEW** - Submit a topographic map, extending one mile beyond the property boundaries, showing the injection well(s) or project area for which a permit is sought and the applicable area of review. The map must show all intake and discharge structures and all hazardous waste treatment, storage, or disposal facilities. If the application is for an area permit, the map should show the distribution manifold (if applicable) applying injection fluid to all wells in the area, including all system monitoring points. Within the area of review, the map must show the following:

Class I

The number, or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, mines (surface and subsurface), quarries, and other pertinent surface features, including residences and roads, and faults, if known or suspected. In addition, the map must identify those wells, springs, other surface water bodies, and drinking water wells located within one quarter mile of the facility property boundary. Only information of public record is required to be included in this map;

Class II

In addition to requirements for Class I, include pertinent information known to the applicant. This requirement does not apply to existing Class II wells;

Class III

In addition to requirements for Class I, include public water systems and pertinent information known to the applicant.

C. **CORRECTIVE ACTION PLAN AND WELL DATA** - Submit a tabulation of data reasonably available from public records or otherwise known to the applicant on all wells within the area of review, including those on the map required in B, which penetrate the proposed injection zone. Such data shall include the following:

Class I

A description of each well's types, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Director may require. In the case of new injection wells, include the corrective action proposed to be taken by the applicant under 40 CFR 144.55.

Class II

In addition to requirement for Class I, in the case of Class II wells operating over the fracture pressure of the injection formation, all known wells within the area of review which penetrate formations affected by the increase in pressure. This requirement does not apply to existing Class II wells.

Class III

In addition to requirements for Class I, the corrective action proposed under 40 CFR 144.55 for all Class III wells.

D. **MAPS AND CROSS SECTION OF USDWs** - Submit maps and cross sections indicating the vertical limits of all underground sources of drinking water within the area of review (both vertical and lateral limits for Class I), their position relative to the injection formation and the direction of water movement, where known, in every underground source of drinking water which may be affected by the proposed injection. (Does not apply to Class II wells.)

E. **NAME AND DEPTH OF USDWs (CLASS II)** - For Class II wells, submit geologic name, and depth to bottom of all underground sources of drinking water which may be affected by the injection.

F. **MAPS AND CROSS SECTIONS OF GEOLOGIC STRUCTURE OF AREA** - Submit maps and cross sections detailing the geologic structure of the local area (including the lithology of injection and confining intervals) and generalized maps and cross sections illustrating the regional geologic setting. (Does not apply to Class II wells.)

G. **GEOLOGICAL DATA ON INJECTION AND CONFINING ZONES (Class II)** - For Class II wells, submit appropriate geological data on the injection zone and confining zones including lithologic description, geological name, thickness, depth and fracture pressure.

H. **OPERATING DATA** - Submit the following proposed operating data for each well (including all those to be covered by area permits): (1) average and maximum daily rate and volume of the fluids to be injected; (2) average and maximum injection pressure; (3) nature of annulus fluid; (4) for Class I wells, source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids; (5) for Class II wells, source and analysis of the physical and chemical characteristics of the injection fluid; (6) for Class III wells, a qualitative analysis and ranges in concentrations of all constituents of injected fluids. If the information is proprietary, maximum concentrations only may be submitted, but all records must be retained.

I. **FORMATION TESTING PROGRAM** - Describe the proposed formation testing program. For Class I wells the program must be designed to obtain data on fluid pressure, temperature, fracture pressure, other physical, chemical, and radiological characteristics of the injection matrix and physical and chemical characteristics of the formation fluids.

For Class II wells the testing program must be designed to obtain data on fluid pressure, estimated fracture pressure, physical and chemical characteristics of the injection zone. (Does not apply to existing Class II wells or projects.)

For Class III wells the testing must be designed to obtain data on fluid pressure, fracture pressure, and physical and chemical characteristics of the formation fluids if the formation is naturally water bearing. Only fracture pressure is required if the program formation is not water bearing. (Does not apply to existing Class III wells or projects.)

J. **STIMULATION PROGRAM** - Outline any proposed stimulation program.

K. **INJECTION PROCEDURES** - Describe the proposed injection procedures including pump, surge, tank, etc.

L. **CONSTRUCTION PROCEDURES** - Discuss the construction procedures (according to §146.12 for Class I, §146.22 for Class II, and §146.32 for Class III) to be utilized. This should include details of the casing and cementing program, logging procedures, deviation checks, and the drilling, testing and coring program, and proposed annulus fluid. (Request and submission of justifying data must be made to use an alternative to packer for Class I.)

M. **CONSTRUCTION DETAILS** - Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.

N. **CHANGES IN INJECTED FLUID** - Discuss expected changes in pressure, native fluid displacement, and direction of movement of injection fluid. (Class III wells only.)

O. **PLANS FOR WELL FAILURES** - Outline contingency plans (proposed plans, if any, for Class II) to cope with all shut-ins or wells failures, so as to prevent migration of fluids into any USDW.

P. **MONITORING PROGRAM** - Discuss the planned monitoring program. This should be thorough, including maps showing the number and location of monitoring wells as appropriate and discussion of monitoring devices, sampling frequency, and parameters measured. If a manifold monitoring program is utilized, pursuant to §146.23(b)(5), describe the program and compare it to individual well monitoring.

Q. **PLUGGING AND ABANDONMENT PLAN** - Submit a plan for plugging and abandonment of the well including: (1) describe the type, number, and placement (including the elevation of the top and bottom) of plugs to be used; (2) describe the type, grade, and quantity of cement to be used; and (3) describe the method to be used to place plugs, including the method used to place the well in a state of static equilibrium prior to placement of the plugs. Also for a Class III well that underlies or is in an exempted aquifer, demonstrate adequate protection of USDWs. Submit this information on EPA Form 7520-14, Plugging and Abandonment Plan.

R. **NECESSARY RESOURCES** - Submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.

S. **AQUIFER EXEMPTIONS** - If an aquifer exemption is requested, submit data necessary to demonstrate that the aquifer meets the following criteria: (1) does not serve as a source of drinking water; (2) cannot now and will not in the future serve as a source of drinking water; and (3) the TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and is not reasonably expected to supply a public water system. Data to demonstrate that the aquifer is expected to be mineral or hydrocarbon production, such as general description of the mining zone, analysis of the amenability of the mining zone to the proposed method, and time table for proposed development must also be included. For additional information on aquifer exemptions, see 40 CFR Sections 144.7 and 146.04.

T. **EXISTING EPA PERMITS** - List program and permit number of any existing EPA permits, for example, NPDES, PSD, RCRA, etc.

U. **DESCRIPTION OF BUSINESS** - Give a brief description of the nature of the business.

Acronyms and Abbreviations

µmhos/cm	micromhos per centimeter
AFC	Application for Certification
AOR	Area of Review
API	American Petroleum Institute
bgs	below ground surface
BOPE	blowout prevention equipment
CFR	Code of Federal Regulations
Delta	the Sacramento-San Joaquin River Delta
DOGGR	Division of Oil, Gas, and Geothermal Resources
DST	drillstem test
DWR	Department of Water Resources
EPA	U.S. Environmental Protection Agency
ft	feet
fpm	feet per minute
gpm	gallons per minute
HCO_3	bicarbonate
HRB	heat recovery boilers
HRSG	heat recovery steam generator
I-5	California's Interstate 5
lb/ft^3	pounds per cubic feet
LEC	Lodi Energy Center
md	millidarcies
md/ft	millidarcies per foot
mg/L	milligrams per liter
MW	megawatt
NaCl	sodium chloride
NCPA	Northern California Power Agency

psi	pounds per square inch
psi/ft	pounds per square inch per foot
RCRA	Resource Conservation and Recovery Act of 1976
RO	reverse osmosis
SiO_2	silica dioxide
SO_4	sulfate
ST&C	short thread couplings
STIG	steam injected gas turbine
STIG-LEC facility	joint reference to the existing STIG power plant facility and the proposed LEC power plant facility
TDS	total dissolved solids
TSS	total suspended solids
UF	ultrafiltration
UIC	Underground Injection Control
USDW	underground source of drinking water
USGS	United States Geological Survey
WPCF	water pollution control facility
ZEI	Zone of Endangering Influence

Introduction

Background

Northern California Power Agency (NCPA) currently owns and operates the Combustion Turbine Project #2 (steam injected gas turbine [STIG] plant), an electrical generating plant located in the City of Lodi, San Joaquin County (Figure 1). NCPA is in the process of preparing an Application for Certification (AFC) for a second power plant, the Lodi Energy Center (LEC), to be located immediately adjacent to the STIG plant. The two power plants are located in a complex that also includes the City of Lodi's White Slough Water Pollution Control Facility (WPCF) to the east and the San Joaquin County Mosquito and Vector Control facility to the south (Figure 2). In this application, the existing and proposed power plant facilities will be referred to jointly as the STIG-LEC facility. The facility layout and well locations are shown in Figure 3.

As part of its waste-disposal process, the STIG plant has owned and operated an onsite Class I injection well, referred to as STIG-1 U.S. Environmental Protection Agency ([EPA] Permit CA194000002, Appendix 1). STIG-1 was constructed in 1993 and has operated efficiently and effectively since routine operation began in 2000. Therefore, as part of the planned operation of the LEC facility, installation of a second Class I injection well will support the facility. In addition, a possible third well may be installed at a future date to serve as a back-up well for the two dedicated injection wells. This application addresses the permitting process for each of these wells:

- STIG-1 reapplication
- LEC-1 new installation application
- LEC-2 (backup well) new installation application

This application will consider the NCPA site injection of a total maximum of 425 gallons per minute (gpm) of disposal fluid into the Domengine Formation. The existing STIG-1 well is permitted to inject up to 200 gpm, although it has only injected, on average, 100 gpm. The planned injection rate of the LEC-1 well is 225 gpm. The backup well, LEC-2, would not operate above 225 gpm—it will serve as a backup well to either STIG-1 or LEC-1 at any given time, but will not back up both wells concurrently. Therefore, the maximum permitted injection rate at the NCPA site is 425 gpm.

Plant Overview

The STIG plant began operation in April of 1995[1]. NCPA currently operates the STIG plant when electricity is needed during high demand periods. The STIG-1 well, therefore, only injects waste when the Combustion Turbine #2 (CT2) STIG plant is operational. The STIG plant injects a minimum of 20 percent of its wastewater.

[1] Prior to the STIG-1 well beginning routine operation in 2000, wastewater generated at the STIG facility was returned to the White Slough WPCF.

The process water supply for both power plants is treated wastewater from the White Slough WPCF. NCPA has a will-serve letter from the City of Lodi to receive the treated wastewater for the LEC plant. In the case of the STIG plant, NCPA receives treated wastewater as part of its lease agreement with the City. NCPA is required in its White Slough agreement with the City to inject at least 20 percent of the wastewater on a yearly basis. The remainder is returned to the WPCF. The LEC facility will be required to inject 100 percent of the water it receives. No return flow will be accepted by the WPCF. The three City documents—the lease, the agreement to return STIG wastewater, and the will-serve letter—are included in Appendix 2.

The LEC plant will be a baseload plant to meet routine power demands. The plant operation will be different than the STIG plant, with process water being recycled through the system 5 to 7 times. This will result in injection water having slightly different water chemistry than that currently being injected at STIG-1, which is discussed in Attachment H of this application.

Construction on the LEC plant is planned to begin in 2010, with operation commencing in 2012. The LEC-1 well is planned to be installed and tested prior to beginning plant construction. After completion of the LEC, NCPA will operate the STIG-1 and LEC-1 as dedicated wells for each of their respective plants. However, each well would serve as a "back up" well for the other in case of operational or mechanical interruptions, up to the permitted injection rate for the operating well. If this approach does not enable both plants to be fully-functional, NCPA will consider installing LEC-2 as a back up well to both STIG-1 and LEC-1. This is discussed further in Attachment O.

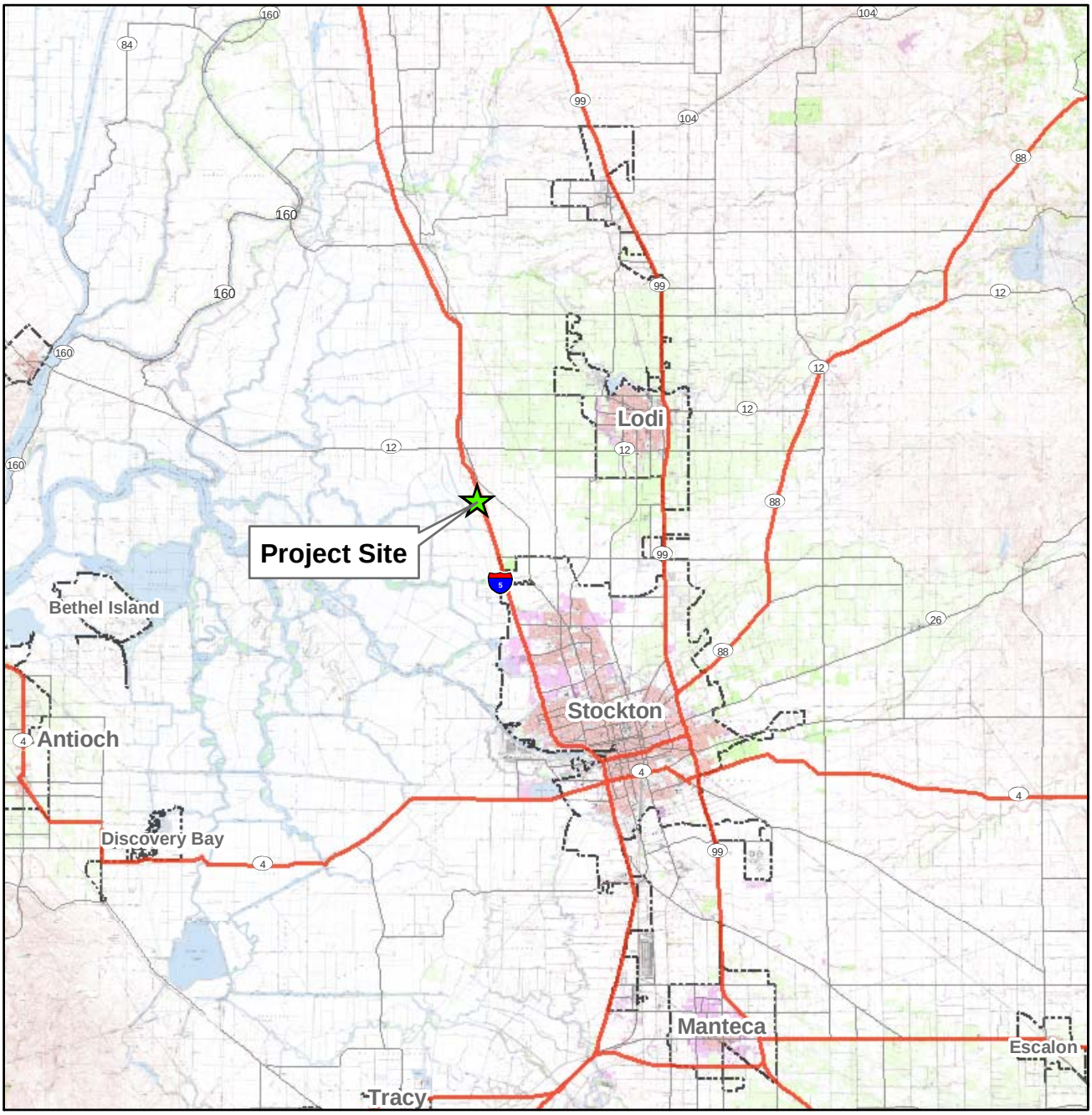
Application Organization

The EPA application form precedes this Introduction section. Each attachment specified in the application guidelines are then included. Finally, there a series of appendixes included to provide supporting information to the application.

At the beginning of each attachment, the instructions included in the application are included under the header "Application Requirement." An approach section usually follows, which describes how the required information is presented. Because this application addresses an existing and two proposed wells, what is presented in the application may vary. For example, there is operating data for STIG-1 to present in Attachment H, but only modeled data for LEC-1 or LEC-2. How the data or information is presented is discussed in the Approach section. Figures for each attachment are included at the end that attachment.

Supplemental information, which was either submitted as part of the original 1993 application, or is needed to support what is presented in the current application attachments, is presented as appendixes. These appendixes are included after the attachments.

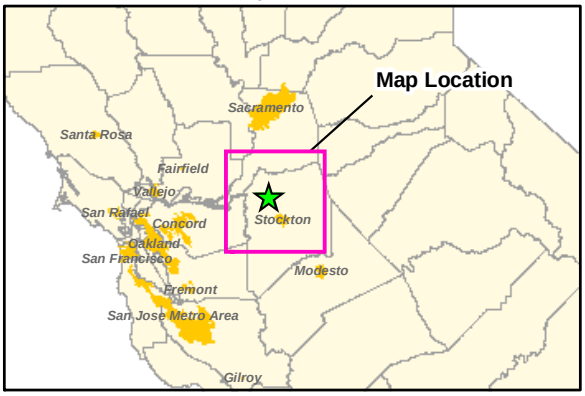
Figures



LEGEND

Project Site

VICINITY MAP



N

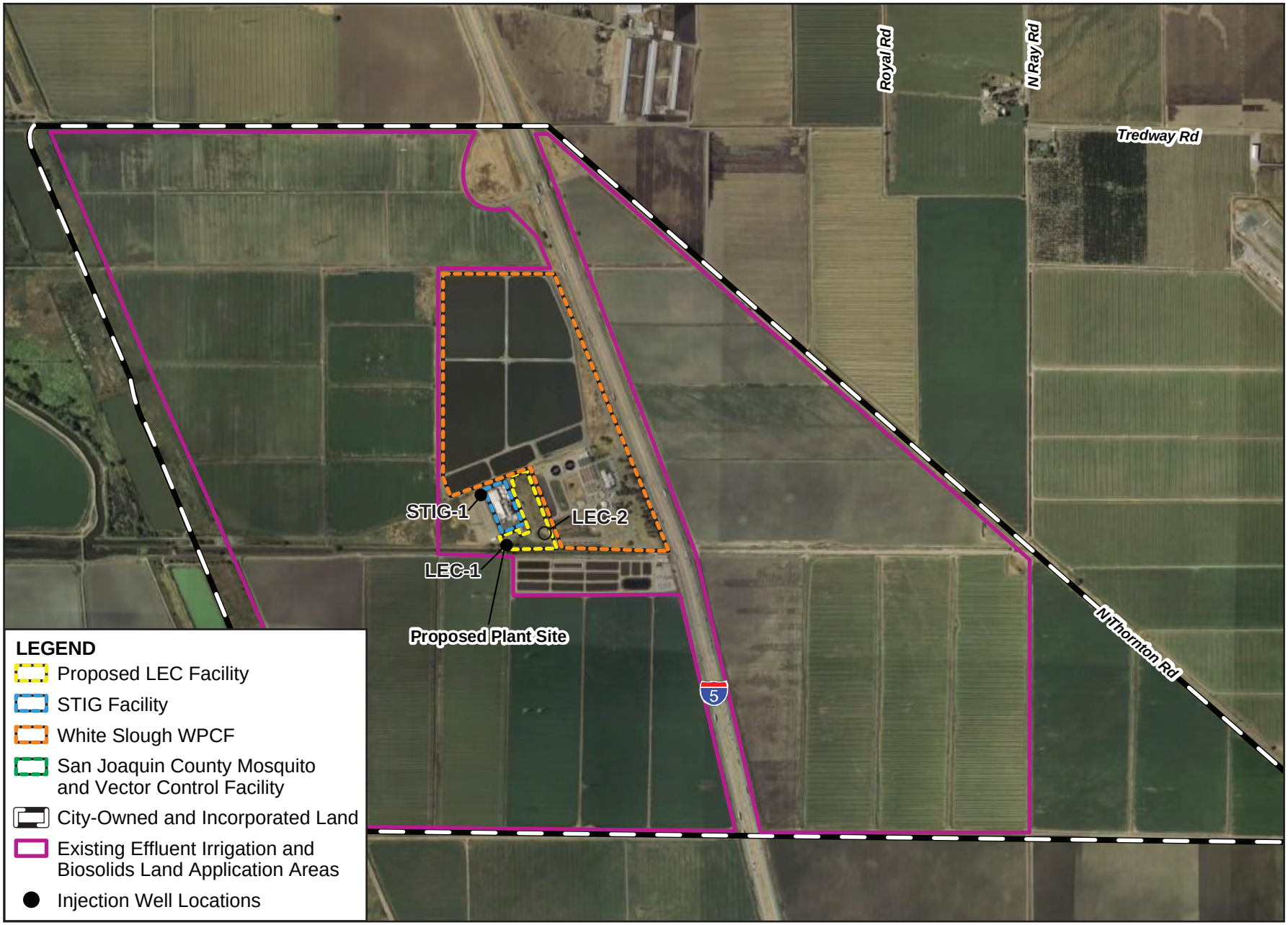
0 3 6
Miles

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

FIGURE 1
PROJECT VICINITY MAP
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL

SAC\\ZION\SACGIS\PROJ\LODIENERGYCENTER_371322\MAPFILES\VICINITYMAP.MXD MHASKELL 8/15/2008 06:20:48
EY062008001SAC Figure_1.ai 09.9.08 afint



This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

0 1,000 2,000
Feet

N

FIGURE 2
SITE LOCATION
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL

EY062008001SAC Figure_2.ai 09.26.08 tdaus

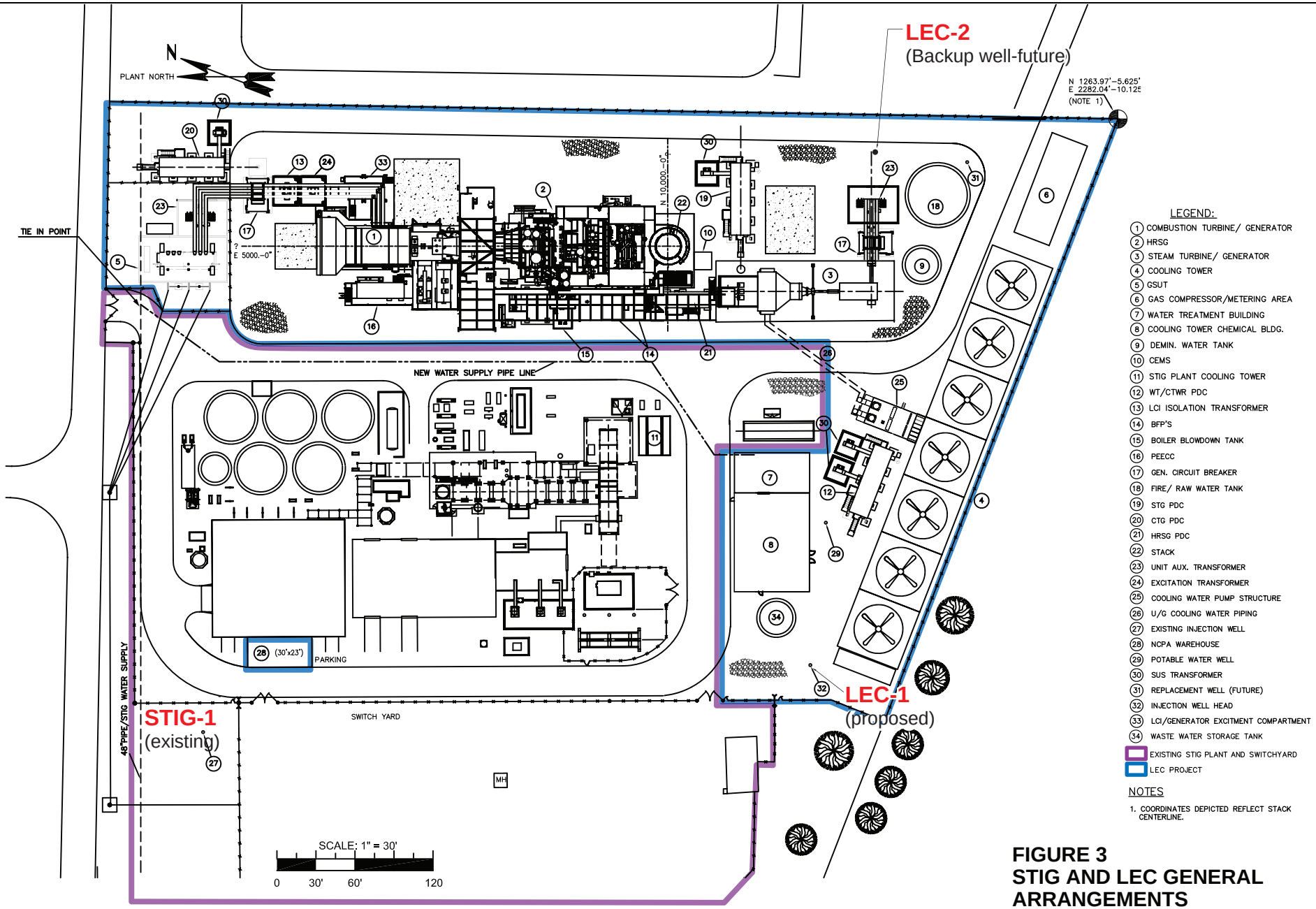


FIGURE 3
STIG AND LEC GENERAL ARRANGEMENTS
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Source: Worley Parsons LTD, Drawing LODI-0-SK-111-007-001C, 08-19-08

Attachment A
Area of Review Methods

Application Requirements

Give the methods and, if appropriate, the calculations used to determine the size of the Area of Review (fixed radius or equation). The area of review shall be a fixed radius of 1/4-mile from the well bore, unless the use of an equation is approved in advance by the Director.

Approach

A single Area of Review (AOR) was developed for the STIG-LEC facility wells because of the relatively small dimensions of the overall site. The AOR considered the maximum potential injection rates for the STIG-1 and LEC-1 wells over the next 30 years (the life expectancy of the power plants). This approach provided the 'worst case scenario' for assessing potential impacts of the injection process over time because it focused the injection on two wells. Results for 10 years, the duration of the permit request, are also considered. Although specific assessment of injection at LEC-2 was not directly conducted, its role as a backup well was considered as part of the overall injection scheme at the STIG-LEC.

Methodology

Three independent methods are available to decide the appropriate size of the area to be surveyed to assess the possible impact of the proposed use of an injection well on underground sources of drinking water (USDWs). Those methods are the fixed radius method, the volumetric method, and the pressure build-up method. The results from applying each of those methods to determine an appropriate-sized AOR for the NCPA STIG-LEC facility are described below.

It was assumed that the fully permitted injection rates for the STIG-1 (200 gallons per minute [gpm]) and LEC-1 (225 gpm) wells were achieved 24 hours per day, 365 days per year for the next 30 years. Injection was assumed to occur from a single point located at the center of the facility.

Formation properties used for the calculations were taken from the original permit application and subsequent testing activities performed during mechanical integrity testing (MIT). Original data for the permit was collected through research on nearby wells, geophysical logging, and injection testing. Permeability is one of the parameters critical for determining long term pressure increases. Due to the nature of evaluating pressure response to injection, combined with minor differences in testing procedures and initial reservoir conditions, results of the tests have varied as shown in Table A-1. The original value of permeability and net sand thickness based on perforated intervals was selected to provide the most conservative estimated distances for the AOR.

TABLE A-1
Measured Reservoir Properties

	06/08/93	12/04/02	12/03/03	12/14/04	2/8/07	03/28/08	Selected
Net Sand Thickness, ft	230	320	320	320	320	320	230
Reservoir Conductivity, md-ft	12,500	61,400	66,600	55,300	26,964	56,435	12,500
Permeability, md	54.4	192	208	173	84	176	54.4

Area of Review

The AOR around one or more injection wells is the area of most detailed study related to the Underground Injection Control (UIC) permit (EPA, 2002). The primary concern of the UIC program is the potential for injected fluid or poor quality native formation fluids to move from the injection interval due to inadequate confinement or the presence of natural or man-made conduits. Examples of natural conduits include transmissible faults or fractures that penetrate the confining zone. Man-made conduits at this depth are generally wells that may not be properly constructed and/or plugged to prevent movement of fluids from deeper zones to shallower zones.

The area of review may be based on a fixed radius around the well, or it may be calculated based on site-specific data. There are three types of evaluations to determine an appropriate area of review:

1. Fixed Radius
2. Volumetric Calculations
3. Pressure Calculations

These methods are considered and compared in the following sections.

Fixed Radius

The fixed radius method is mandated by the U.S. Environmental Protection Agency (EPA) based on experience in a variety of geologic settings. The method does not take into account any site-specific information, but provides a minimum distance to consider when conducting an AOR analysis. In California, EPA Region 9 requires a minimum 1/4-mile distance around the well to be evaluated. This minimum value is compared to calculated values below.

Volumetric Calculations

A volumetric assessment is a simple method for estimating the area of review (AOR) using site-specific information. This method calculates the area over which a given volume of injected fluid will spread, given total formation thickness and porosity. The methodology assumes that the injection fluid will fill an expanding cylinder moving away from the injection well. It assumes that formation thickness and porosity are uniform. This method

estimates the fluid front radius only and does not consider the pressure buildup that defines the Zone of Endangering Influence (ZEI).

The following calculations use porosity and formation thickness values from STIG #1. The formation thickness is based on the completed formation thickness in that well (approximate interval from top perforation to bottom perforation) as evaluated during testing activities carried out since the well was put into operation (Fairchild and Wells, Inc, 2007). This is a conservative assumption, since the Domengine Formation is actually over 800 feet thick in the area of the proposed injection well, LEC-1 (NCPA, 1993) and the LEC-1 and LEC-2 wells are planned to be perforated over a thicker interval (approximately 4,230 to 4,575 feet bgs) than that used in the calculations.

The following equation and values for variables (Table A-2) were used to calculate the AOR using the volumetric method:

$$R = \left(\frac{V}{23.4HP} \right)^{\frac{1}{2}}$$

TABLE A-2
Volumetric Calculations Summary for 10 Years

Variable	Description	Value
V	Volume of injected fluid, gallons	2.3 billion gallons
H	Height or thickness of injection zone, feet	230 ft
P	Porosity of injection zone, percent	35.3%
R	Radius of invaded zone, feet	936 ft[1]

[1] based on 10 years of future injection

Based on records of actual injection at the site, a total of 71.5 million gallons has been injected starting in 1993. Future injection activities at the site are planned with a maximum instantaneous injection rate of 425 gpm. At this maximum rate, a total of approximately 2.2 billion gallons of water will be injected in the next 10 years and 6.7 billion gallons over the next 30 years. Adding previous and planned future injection volumes, the total volume is approximately 2.3 billion gallons resulting in a radius of 936 ft or 0.18 miles in 10 years and 6.8 billion gallons resulting in a radius of 1,604 ft or 0.30 miles in 30 years.

In general, the total distance injectate will travel will be larger than calculated above due to dispersion and channeling through discrete, highly permeable pathways within the formation. The following equation and values for variables (Table A-3) can be used to estimate a more conservative distance traveled in 30 years including the influence of dispersion:

$$R' = R + 2.3\sqrt{DR}$$

TABLE A-3
Volumetric Calculations Summary including Dispersion for 30 Years

Variable	Description	Value
R	Radius of Invaded Zone, feet	1,604 ft*
D	Dispersion Coefficient, feet	3 ft
R'	Radial Distance with Dispersion, feet	1,763 ft

*Based on 30 years of future injection

Zone of Endangering Influence

The primary concern related to pressure increases around an injection well is the endangerment of USDW. This occurs when the pressure increases in the injection zone to levels that exceed the pressure in upper zones. This pressure difference can drive water from the injection zone into shallower zones through conduits described above. The ZEI is the area over which the increased pressure in the injection zone could push injected or native fluids into an overlying USDW.

In the case of the STIG-LEC site, the only identified conduits through which fluids could migrate from the injection zone to a USDW, are test holes or oil and gas wells present in the area. No faults have been identified in the immediate vicinity of the site. In order for the boreholes to pose a threat to any USDW, the pressure increase in the injection zone must be greater than the required pressure to displace the drilling fluid left in the hole. In order for drilling fluid to be displaced, the hydrostatic pressure and gel strength of the mud must be overcome (Johnston and Knape, 1986). Therefore, the allowable pressure increase in the formation can be calculated using the following equations:

$$\Delta P_{Allowable} = P_H + P_G$$

where

$$P_H = (.052)(H)(\rho_{mud})$$

and

$$P_G = \frac{0.0033(GS)(H)}{D}$$

TABLE A-4
Allowable Pressure Increase Variables

Variable	Description	Value
$\Delta P_{allowable}$	Allowable Pressure Increase, pounds per square inch	175 psi
P_H	Hydrostatic Pressure of Mud Column, pounds per square inch	141 psi
P_G	Pressure for Mud Displacement	34 psi
H	Depth of Mud Column, feet	4,100 ft
ρ_{mud}	Density of mud, pounds per gallon	9 ppg
GS	Gel Strength, pounds/100 ft^2	20 lb/100 ft^2
D	Diameter of Borehole, inches	8 in

Based on 30 years of future injection

Pressure Build-Up Calculations

In order to determine the zone of endangering influence defined as the distance where pressure increase is greater than the calculated allowable pressure increase, the following equation and values for variables was used.

Formation pressure can be calculated at specific times and distances from the injection well using the following equation (Matthews and Russell, 1967).

$$P(r,t) = P_i + \frac{162.6Q\mu B}{kh}\left[\log\left(\frac{kt}{\phi\mu c r^2}\right) - 3.23 + 0.87s\right]$$

Solving the above equation for various times and applying the principle of superposition, the estimated pressure at each of the wells, STIG-1 and LEC-1, can be estimated. Table A-3 and Figure A-1 show expected pressures at the wells, including the effects of interference. Figure A-2 shows the calculated pressure increase at LEC-1 over a 30-year period, and Figure A-3 compares calculated formation pressures to estimated fracture pressure at the site.

Based on the fracture gradient of 0.73 psi/ft and a top perforation depth of 4,234 ft, the fracture pressure is 2,993 psi. Initial formation pressure is approximately 1,857 psi. Based on parameter values used in the above equations, the pressure increase in the injection zone is expected to remain well below fracture pressure after continuous injection at proposed rates for 10 years.

Applying the equation for the total site injection rate of 425 gpm for 30 years, pressure increase vs. distance from the site can be plotted as shown in Figure A-4.

As shown in Figure A-4, the distance where the pressure increase exceeds the allowable value is approximately 1.16 miles.

TABLE A-5
Pressure Buildup Calculations Summary—LEC-1

Variable	Description	Value
P_i	Initial reservoir pressure at 4100 feet, pounds per square inch	1,779 psi
Q	Injection rate, barrels/day	14,571 bpd (425 gpm)
μ	Viscosity of injected fluid, centipoise	0.54 cp
B	Formation Volume Factor, dimensionless	1
K	Formation permeability, millidarcies	54.4 md
H	Formation height or thickness, feet	230 ft
T	Time since injection began, hrs	87,600 hrs (10 yrs)
ϕ	Porosity, percent	35.3%
C	Formation Compressibility, feet/psi	7.5×10^{-6}
R	Radius or distance from injection well, feet	variable
S	Skin factor, dimensionless	Zero*
P(r,t)	Pressure as a function of r and t, psi	variable

*Skin factor is a measure of well efficiency applicable for pressure calculated in the well only.

Modified Theis – Zone of Endangering Influence

The zone of endangering influence is the area where the injection zone pressure exceeds pressure in overlying USDWs. . The following equation is used for calculating the distance where pressure of the injection interval increases above the allowable pressure (modified from 40 CFR 146.6).

$$r = \left(\frac{2.25KHt}{S10^{x}} \right)^{\frac{1}{2}}$$

Where the exponent x is calculated as

$$x = \frac{4\pi KH\left(\Delta P_{allowable}\right)}{2.3Q}$$

TABLE A-6
Zone of Endangering Influence Calculations Summary (425 gpm)

r	radius of endangering influence from injection well (ZEI), ft	4,219 ft (0.8 miles)
K	hydraulic conductivity of the injection zone, ft/day	5.91E-01 ft/day
H	thickness of the injection zone, ft	230 ft
t	duration of injection, project life, days	3,650 days (10 years), 10,950 days (30 years)
S	storage coefficient, dimensionless	6.00E-04
Q	injection rate, ft^3/day	81,813 ft3/day (425 gpm)
$P_{allowable}$	Allowable Pressure Increase	175 psi (403 ft)

Based on the conservative assumptions for parameter values and injection rates and durations, the total radius suggested by the above equation is 0.8 miles based on 10 years of injection. For 30 years of injection, the same calculation results in a radius of 1.4 miles.

Summary of Area of Review Calculations

Each of the AOR calculation methodologies considered that the fully permitted injection rates for the STIG-1 (200 gpm) and LEC-1 (225 gpm) wells were achieved 24 hours per day, 365 days per year for the next 30 years. In reality, this rate of injection is not expected to occur. For example, the STIG facility is a 'peaker plant' – it provides power during periods when demands are high and supplemental power sources are needed. Consequently, the plant often does not operate during the winter months and even when the plant is operating, the injection well does not operate 24 hours per day. Based on review of the historic operation of the STIG-1 well since it began routine operation in 2000, the well has injected a total of 71.5 million gallons. This is approximately 10 percent of the potential maximum 788 million gallons the well could have injected between January 1, 2000 and July 31, 2008. Even at its peak year of operation in 2001 during the California Energy Crisis, STIG-1 injected 29.9 million gallons, approximately 28 percent of its potential capacity. Although it is unknown what rate the STIG-1 will operate at in the future, operation 100 percent of the time is not expected.

The LEC plant is a baseload plant and is expected to have an operation that is closer to its potential than the STIG plant. Considering periodic maintenance and periods of lower energy demands, a conservative assumption of 90 percent operation is possible.

Based on the calculations summarized in this attachment, the injection front is expected to travel less than 1,800 feet from the injection well, including the historic STIG-1 injection and estimated dispersion. This extends the area of fluid migration to beneath the adjacent City of Lodi property (Appendix 3). These calculations assume 24 hour per day, 365 days per year of injection for 30 years at 425 gpm. Additionally, the pressure increase caused by the injection activities extends well beyond the front of injected fluid. Because the initial pressure of the injection formation is nearly hydrostatic, close to the same pressure as the USDW in the area, small increases in pressure expand the ZEI to large distances as shown using the modified Theis calculation above. However, the full formation thickness of the

injection zone is approximately 800 feet thick, reducing pressure in the formation at great distances from the well. Additionally, the presence of the extensive confining unit will prevent the formation fluids from moving between zones, except in locations where there are conduits. There are relatively few wells in the area (see discussion below). In addition, there are no known faults or fractures within the Area of Review that could serve as conduit for upward flow of injectate or poor quality water. Finally, it is not expected that the plants will operate at full capacity at all times, most likely at lower rates than the proposed permitted values, resulting in significantly less pressure than calculated based on the assumptions above.

Based on evaluation of the fixed radius and volumetric methods, a relatively small radius of investigation of 0.25 to 0.30 miles is required. The allowable pressure increase method at full permitted rates suggests a radius of approximately 0.8 miles for 10 years and 1.4 miles for 30 years which appears to be conservative based on actual planned injection rates and an injection zone in the LEC-1/LEC-2 wells that is thicker than the 230 feet estimated in these calculations. Based on the calculations summarized above and a desire to be conservative in selecting the radius of the AOR, a total distance of 2 miles was selected.

Potential Impact of Injection Operations on Wells within Area of Review

The wells penetrating the confining zone within 2 miles are provided in Table A-6. Their locations are shown in Figure A-5.

TABLE A-7
DOGGR Wells within 2 Miles of the Site

API Number	Operator	Lease	Well No.	Total Depth (ft)	Spud Date	Abandon Date
7700509	Federal Oil Co.	Federal Imeson	1	4,875	06/02/1955	05/30/1955
7700518	Ferguson & Bosworth	Perrin	1	4,802	12/14/1962	12/18/1962
7720172	Great Basins Petroleum Co.	Rio Blanco	1	5,450	10/14/1972	10/18/1972
7720290	Great Basins Petroleum Co.	City of Lodi	1	6,703	11/22/1976	11/30/1976
7720345	Venoco, Inc.	Ratto	14-1	5,820	10/30/1979	11/05/1979
7720381	Argo Petroleum Corp.	Buttes-Rio Blanco	15-77X	4,931	10/13/1981	10/25/1981
7720484	Princeton Natural Gas, LLC	Piacentine	1-27	4,900	07/4/1986	
7720496	Maxus Exploration Co.	Red House Fee	65-24	5,762	07/1/1987	07/01/1987
7720568	Northern California Power Agency	Lodi STIG	1	4,650	04/29/1993	

The closest well, City of Lodi #1, is approximately 0.35 miles from the injection site. This well was plugged back at the base of the surface casing. Hydrostatic pressure of the abandonment mud was reported as 75 lb/ft^3. The pressure applied at 4,100 feet by the mud is approximately 2,132 psi. The pressure necessary to overcome the gel strength of the mud is estimated to be approximately 35 psi. Reservoir pressure at the well after 10 years of injection is estimated to be 2,058 psi. Therefore, 108 psi of excess hydrostatic pressure is available to prevent fluid movement within the borehole. Similar calculations for the other wells within the area of review are included in Table A-8.

TABLE A-8
Pressure Increase and Hydrostatic Mud Pressure at Wells within the AOR

Well Name	Distance	Pressure Increase		Reservoir Pressure (psi)		Mud Weight (ppg)[1]	Pressure Required to Mobilize Fluid (psi)[2]	Excess Hydrostatic Pressure (psi)
		10 year	30 year	10 year	30 Year			
Great Basins Petroleum Co. City of Lodi #1	1,848	279	328	2,058	2,107	10	2,167	60
Federal Oil Co. Federal Imeson #1	2,587	250	298	2,029	2,077	10.8	2,337	260
Maxus Exploration Co. Red House Fee #65-24	3,749	217	266	1,996	2,045	9.8	2,124	79
Great Basins Petroleum Co. Rio Blanco #1	7,392	158	206	1,937	1,985	10.4	2,252	267
Princeton Natural Gas, LLC Piacentine #1-27	8,448	146	194	1,925	1,973	9.6	2,081	108
Argo Petroleum Corp. Buttes-Rio Blanco #15-77X	8,873	142	190	1,921	1,969	9.9	2,145	176
Venoco, Inc. Ratto #14-1	9,504	136	184	1,915	1,963	10	2,167	204
Ferguson & Bosworth Perrin #1	10,032	131	179	1,910	1,958	10.4	2,248	290

[1]Mud weight based on information from geophysical log headers

[2]Pressure based on hydrostatic pressure of mud column and resistance to flow from mud gel strength.

Following this reasoning and the conservative assumptions related to operations described above, an AOR of 2 miles provides the required level of safety for the USDWs in the area.

Figures

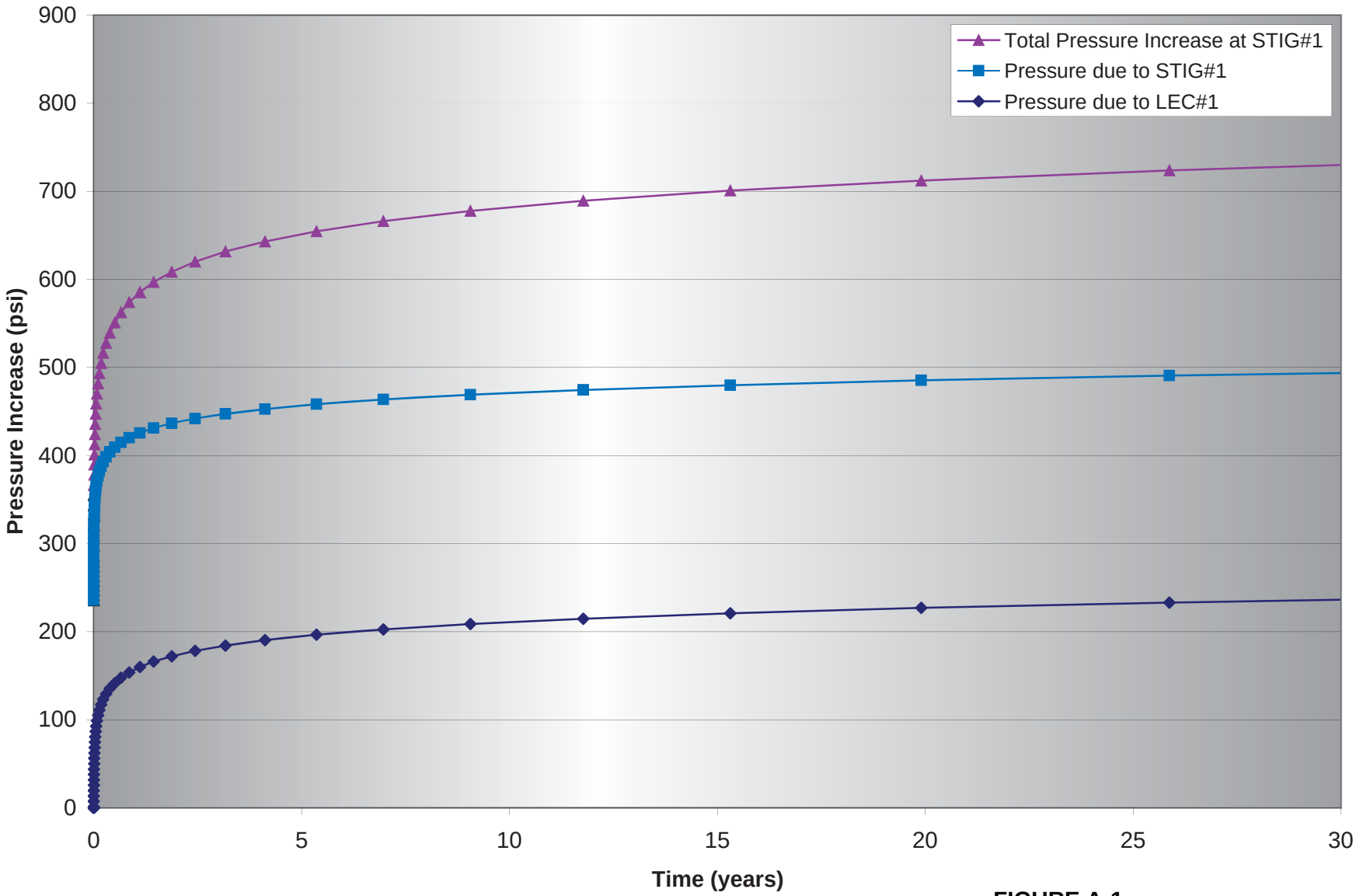


FIGURE A-1
CALCULATED PRESSURE INCREASE AT STIG-1
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

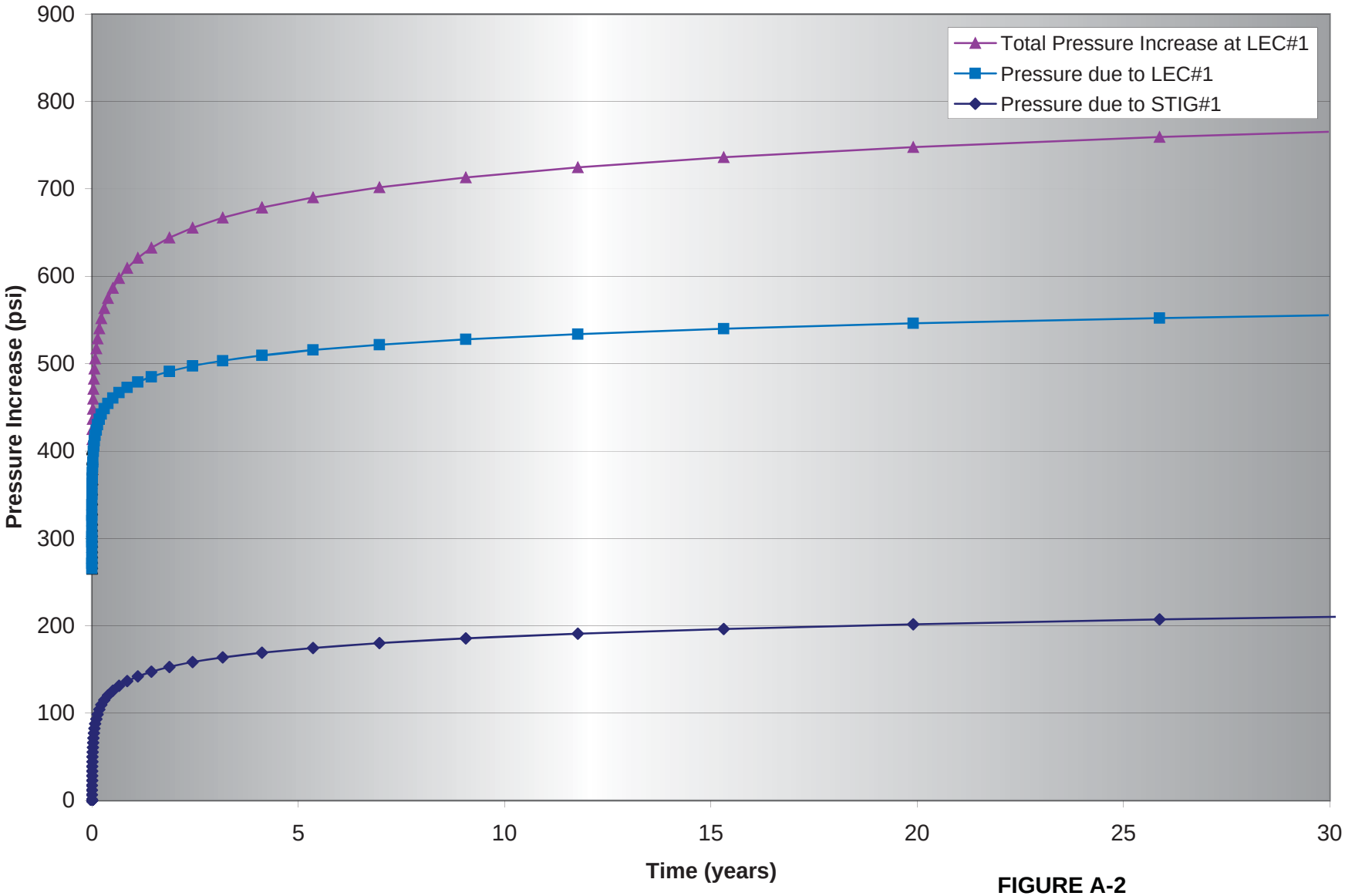


FIGURE A-2
CALCULATED PRESSURE INCREASE AT LEC-1
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

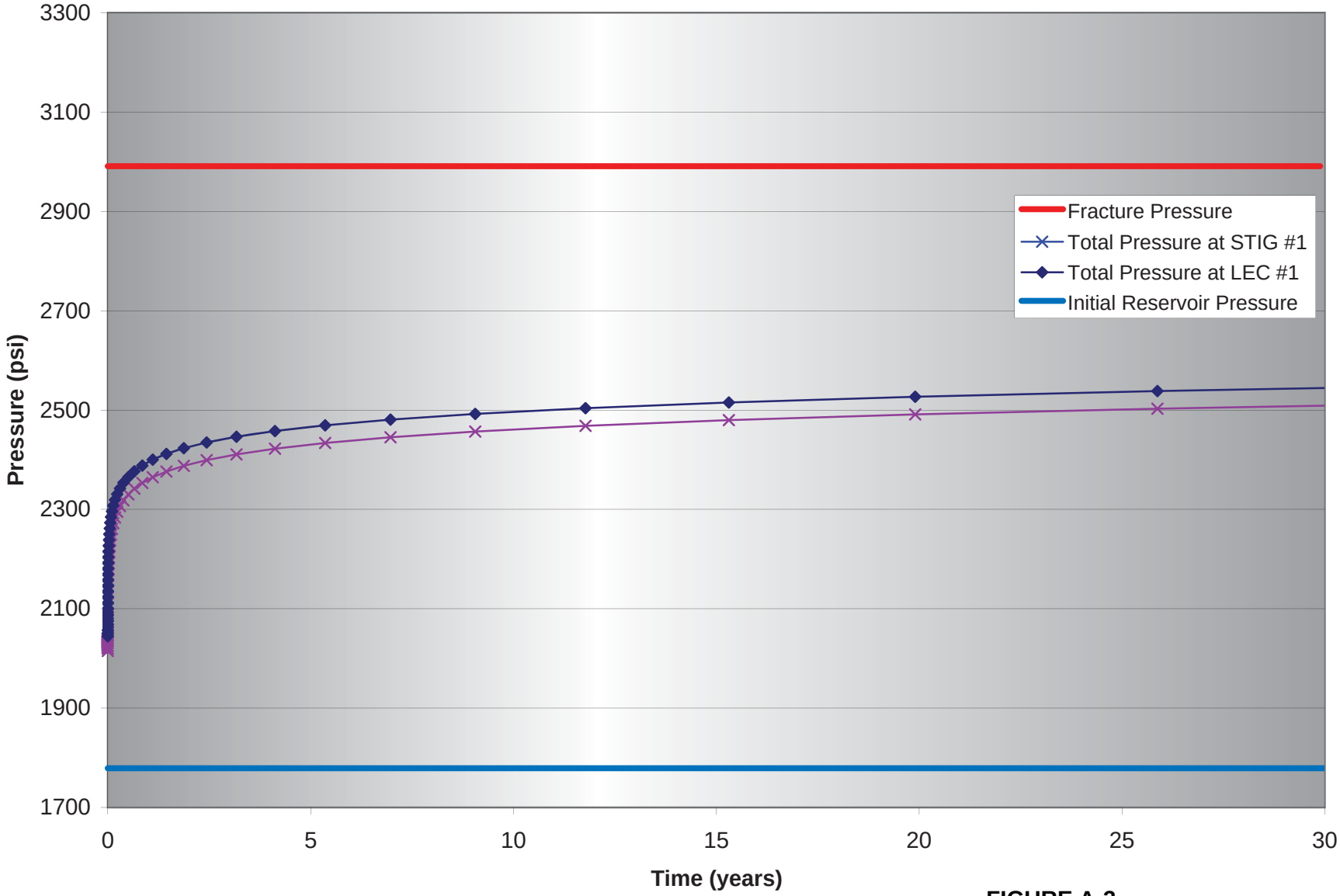


FIGURE A-3
CALCULATED PRESSURE INCREASE VERSUS TIME
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL

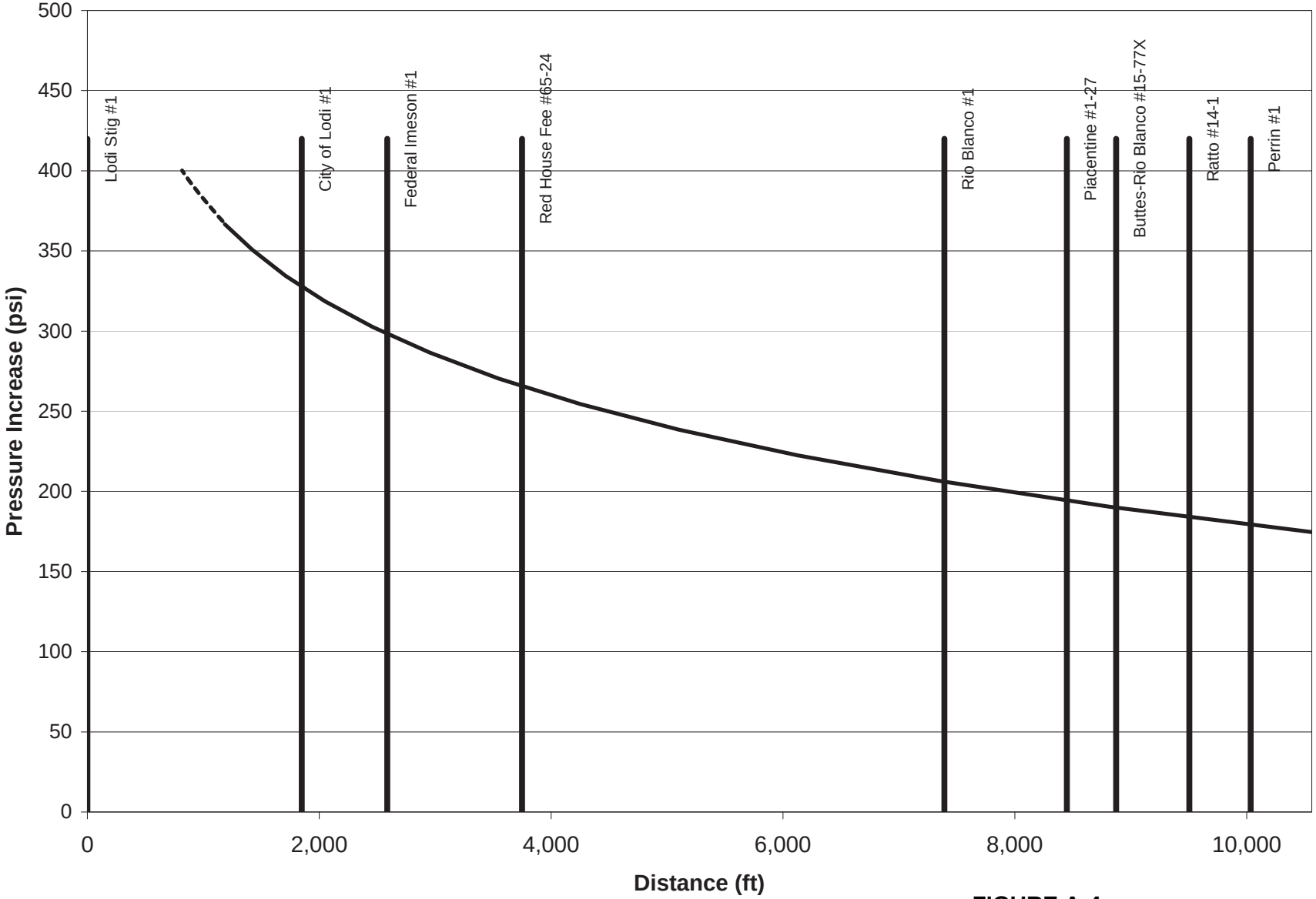
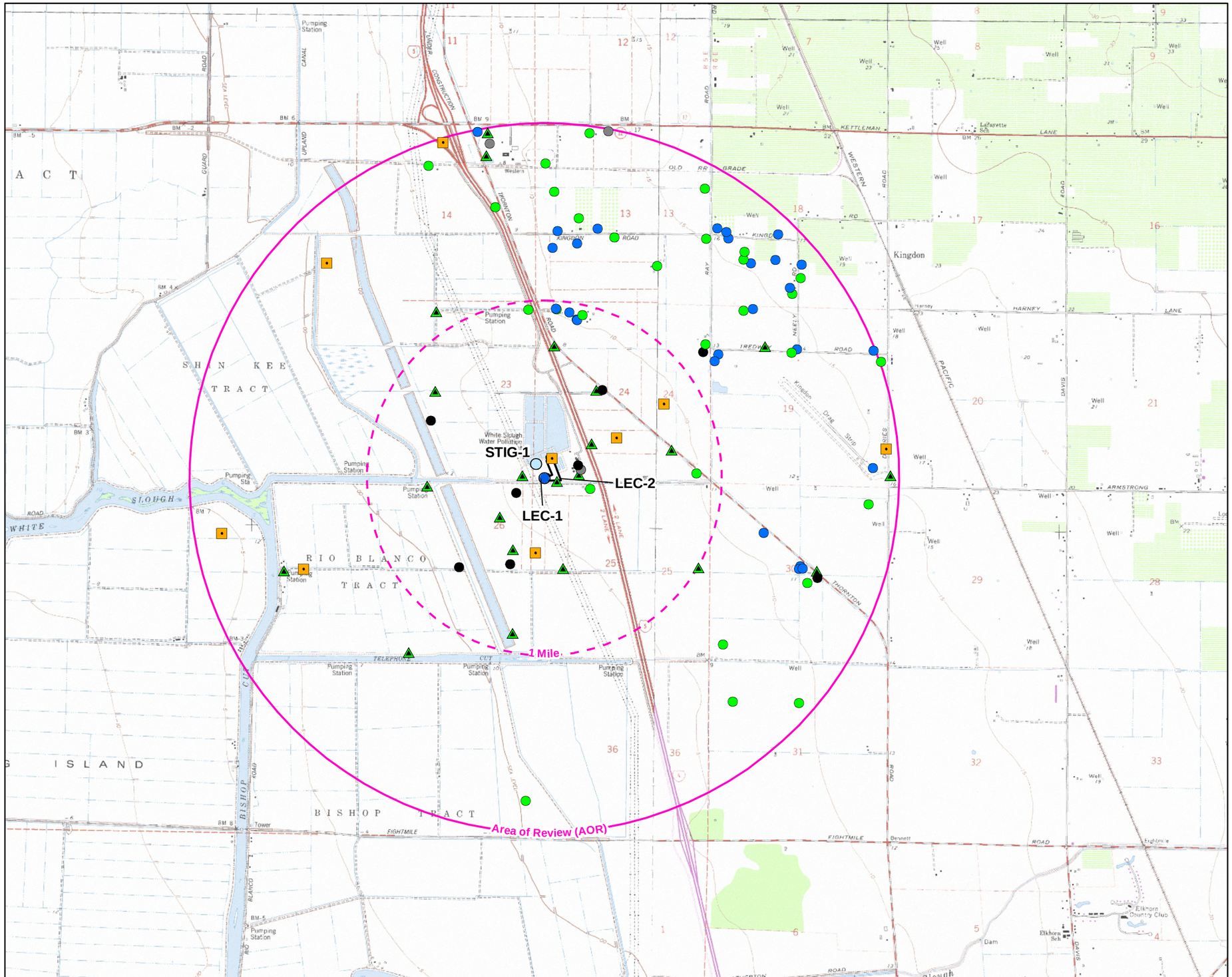


FIGURE A-4
CALCULATED PRESSURE INCREASE WITH DISTANCE FROM SITE AT 10 YEARS
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Well Types

- Domestic
- Industrial/Municipal
- Irrigation
- Monitoring
- Other
- Oil/Gas
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: California Department of Conservation (www.conservation.ca.gov/dog/maps/pages/goto_welllocation.aspx)
2. See Figures B-6 and B-8 for more detailed maps of groundwater and oil/gas wells, respectively.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE A-5
DEEP AND SHALLOW WELLS IN THE AREA OF REVIEW
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\LODIENERGYCENTER_371322\NCPA_LODI_UIW\MAPFILES\SURVEYAREA_GAS2.MXD MHASKELL 9/11/2008 15:04:21

Attachment B
Map of Wells/Area of Review

Application Requirements

Submit a topographic map, extending 1 mile beyond the property boundaries, showing the injection well(s) or project area for which a permit is sought and the applicable area of review. The map must show all intake and discharge structures, and all hazardous waste treatment, storage, or disposal facilities. If the application is for an area permit, the map should show the distribution manifold (if applicable) applying injection fluid to all wells in the area, including all system monitoring points. Within the area of review, the map must show the following.

Class I—The number, or name and location, of all producing wells, injection wells, abandoned wells, dryholes, surface bodies of water, springs, mines (surface and subsurface), quarries, and other pertinent surface features, including residences and roads and faults, if known or suspected. In addition, the map must identify those wells, springs, other surface water bodies, and drinking water wells located within one-quarter mile of the facility property boundary. Only information of public record is required to be included in this map.

Approach

The AOR, as determined by the procedures presented in Attachment A, was determined by imposing the 2-mile radius around each of the three wells—STIG-1, LEC-1, and LEC-2 (backup well). The radii were merged into a single AOR, as shown in Figure B-1.

The southern boundary of the AOR is roughly along 8-Mile Road, the current northern extent of the City of Stockton. The northern boundary of the AOR extends just north of Highway 12, where it intersects with Interstate 5 (I-5). The AOR extends east beyond I-5 and west into the sparsely populated Delta region.

Area Maps

A series of maps have been generated to show both the deep oil and gas wells and the shallower groundwater supply wells. Applicable surface water features within the AOR are also identified. These are presented and discussed in the following.

Physical Setting

The STIG-LEC facility is located within the California's Great Valley geomorphic province and immediately adjacent to the region referred to as the Delta The Delta refers to the flat-lying area formed by the inland confluence of the Sacramento and San Joaquin Rivers. The

STIG-LEC facility is located on the eastern edge of the Delta and just to the west of I-5. Other information on the physical setting of the area is included in the AFC and summarized here.

The STIG-LEC facility is located in the City of Lodi, although the main part of the city is located 6 to 7 miles to the northeast. The land on which the STIG-LEC facility occurs is owned by the City of Lodi, as shown in Figure B-2, and is designated by the City of Lodi as Public/Quasi-Public. Most of the other land owned by the City of Lodi near the power plants, WPCF, and Vector Control facility are used for effluent irrigation and biosolids application. Nearly all other land within approximately 3 miles of the power plant sites are designated by the County as General Agriculture.

The climate in the Lodi area is typical of the Central Valley. The climate, frequently described as Mediterranean, is characterized by warm to hot summers without rainfall. Precipitation in the Lodi area averages about 17 inches per year and occurs between December and April.

Surface Water Features

Numerous natural and developed surface water bodies occur near the STIG-LEC facility. To the west are numerous sloughs, cuts, and canals that deliver surface water to local farmers. The other local surface water features in the area are the percolation ponds at the WPCF, the breeding ponds for fish at the vector control facility, and White Slough. White Slough runs along the south side of the facility, and eventually flows north and drains into the Mokelumne River. Figure B-1 shows these local surface water features.

Along the west side of the City of Lodi property (about 1,500 feet west of the STIG-LEC facility) are several elongate water bodies that roughly parallel I-5. These were initially borrow pits constructed in 1972 to provide material for the construction of I-5. They were originally intended to part of the initial section of the Peripheral Canal. They are now open water bodies. West Yost and Associates (2006) reports that they are not connected directly to the Delta, are recharged by precipitation, and interact with shallow groundwater.

The White Slough Wildlife Area is located northwest of the STIG-LEC facility, and is operated and maintained by the California DFG.

Other Local Features

Two other features occur within the 1-mile radius of the STIG-LEC facility. The first is the high-level electrical transmission lines and the substation on the west side of the STIG facility. The second is four residences located on an unnamed road east of I-5 between Thornton and Kingdon roads.

Well Inventory

Several types of wells occur within the AOR. These include:

- Municipal and Industrial wells
- Domestic wells
- Irrigation wells

- Monitoring wells
- Gas wells

Each of these types of wells is discussed in the following.

Well Inventory Approach

The well inventory used multiple sources of information to develop an inventory as comprehensive as possible. Theses sources include the following:

- California Department of Water Resources (DWR) (http://wdl.water.ca.gov/gw/)
- Unites States Geological Survey (USGS) (http://water.usgs.gov/)
- California DOGGR (http://www.conservation.ca.gov/dog/maps/Pages/goto_welllocation.aspx)
- 2006 City of Lodi Soil and Groundwater Investigation
- San Joaquin County (http://www.sjmap.org/groundwater/)
- 2008 Phase I Environmental Assessment for the NCPA LEC Project
- 1994 Permit to NCPA for STIG Well #1
- Well Drilling Reports (within a 2-mile radius)

The USGS and DWR databases served as the primary source of information for groundwater wells, while the DOGGR online database served as the primary source for oil and gas wells. The additional resources listed above provided supplemental information and verification of the data obtained from the primary sources.

Figure B-3 shows the identified water wells (domestic, irrigation, municipal, and monitoring). Figure B-4 shows the known oil and gas wells. Tables B-1 and B-2 summarize relevant information for the wells shown on Figures B-3 and B-4, respectively.

Municipal and Industrial Supply Wells

Three municipal supply wells were identified during the well inventory. Two are identified as the supply wells for the WPCF, and the third is the supply well for the Flag City complex at the junction of Highway 12 and I-5. According to the drilling report, the two WPCF wells are screened at 104 and 176 feet below ground surface (bgs). These municipal supply wells currently also supply non-potable water to the STIG facility. The Flag City supply well is 170 feet deep.

One industrial supply well was identified within the AOR. This well, located along Highway 12, provides water for a trucking facility.

Domestic Supply Wells

The rural residents within the study area obtain drinking water from individual private domestic wells. Approximately 27 domestic wells have been identified within the AOR from the various sources reviewed. The exact number of wells is uncertain because some well locations were unable to be estimated based on the incomplete or illegible descriptions

included on the water well drillers reports. Additionally, some residences appear in aerial photographs for which well records were not identified. It is possible that a single domestic well supplies water for more than one residence.

The majority of the domestic supply wells within the AOR are located to the east of I-5. The shallowest domestic well identified within the AOR was 51 feet deep. The deepest domestic well identified was 220 feet deep.

Irrigation Supply Wells

Surface water is available throughout the AOR delivered through drains, ditches, and canals, but groundwater is used to supplement surface water supplies to the east of I-5. The only irrigation well within the AOR located west of I-5 is at the golf course on 8-Mile Road.

Approximately 35 irrigation wells were identified within the AOR. Like the domestic well inventory, the exact number of irrigation wells is uncertain because water well completion reports are not available for each well, and records for some locations were uncertain or incomplete.

Irrigation wells generally tend to be deeper than domestic wells. The shallowest irrigation wells within the AOR were 68 feet deep. Shallow irrigation wells in the area are possible because groundwater is so shallow. Irrigation wells up to 450 feet deep occur within the AOR.

Monitoring Wells

Monitoring wells occur in several locations within the AOR, associated with three investigations. These are:

- The WPCP percolation ponds
- Groundwater investigation along Banner Street in the Flag City area
- Groundwater investigation at the Three B's Truck Plaza

The monitoring wells installed along Banner Street and surrounding the WPCP are generally 50 feet deep or shallower. The truck plaza monitoring wells are 150 feet deep and contain multiple monitoring intervals. Because the Banner Street and truck plaza investigations are located at the northern edge of the AOR and are very limited in aerial extent, they are not discussed further.

A series of 22 shallow monitoring wells have been installed near the WPCP. These wells, which extend approximately 20 feet bgs, have been installed to monitor conditions upgradient and downgradient of the percolation ponds at the WPCP.

Oil and Gas Wells

There are four natural gas fields located near the STIG-LEC facility: Harte Gas to the Southeast, Lodi Airport Gas to the East, King Island Gas to the West, and East Islands Gas to the Northwest (see Figure B-5). Of these four, King Island is the only natural gas field with active wells, while the Harte, Lodi Airport, and East Islands fields have all been abandoned. The King Island Gas field has three active wells, one of which is located within the AOR for this project. This well, Piacentine 1-27, is the only well in production in the AOR. The DOGGR online well database also identified seven dry holes in the AOR.

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
1	3	5	24			Monitoring							x	x
2	3	5	23			Monitoring							x	x
3	3	5	26	003N005E26A001M		Other		27	x					
4	3	5	24			Monitoring							x	x
5	3	5	24	003N005E24N001M		Other			x					
6	3	5	24	003N005E24P002M	44089	Municipal	1967	104	x		x		x	x
7	3	5	24	003N005E24P001M	12455	Municipal	1970	142	x		x			x
8	3	5	25			Irrigation		100						x
9	3	5	24			Monitoring							x	
10	3	5	26			Monitoring							x	
11	3	5	26	003N005E26H002M		Monitoring			x	x			x	
12	3	5	26	003N005E26H001M		Other		30	x					
13	3	5	25			Monitoring							x	x
14	3	5	24			Monitoring							x	
15	3	5	24	003N005E24L001M		Unused			x	x			x	
16	3	5	26			Monitoring							x	
17	3	5	26	003N005E26K001M		Other		21	x					
18	3	5	23	003N005E23L001M		Other		30	x					
19	3	5	24			Monitoring							x	
20	3	5	24			Monitoring							x	
21	3	5	23			Monitoring							x	

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
22	3	5	24			Irrigation	1970	144						x
23	3	5	26			Monitoring							x	
24	3	5	24	003N005E24	156307	Domestic	1984	195					x	x
25	3	5	24			Domestic		300						x
26	3	5	24	003N005E24D	366339	Irrigation	1991	198					x	
27	3	5	24	003N005E24C003M	129569	Domestic	1979	150					x	x
28	3	5	23			Irrigation		150						x
29	3	5	24	003N005E24D	548779	Irrigation	1994	210					x	
30	3	5	24			Domestic		150						x
31	3	5	25			Monitoring							x	
32	3	5	23			Monitoring							x	x
33	3	5	24	003N005E24A001M		Other					x			
34	3	6	19	003N006E19E	44388	Domestic	1967	119					x	
35	3	5	24	003N005E24A003M	12463	Irrigation	1970	111					x	
36	3	6	19	003N006E19	412111	Domestic	1994	176						
37	3	5	26			Monitoring							x	
38	3	6	30	003N006E30F	47574	Domestic	1967	75					x	
39	3	5	13	003N005E13M008M	45023	Domestic	1977	124					x	
40	3	5	13	003N005E13L	45001	Domestic	1977	120						
41	3	5	13	003N005E13	742222	Irrigation	2001	190						
42	3	6	30	003N006E30N	39-683	Irrigation		115						

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
43	3	5	13	003N005E13	111977	Domestic	1965	73					x	
44	3	5	13	003N005E13L001M		Irrigation				x		x	x	
45	3	5	13	003N005E13F	47527	Domestic	1969	115						
46	3	6	19			Monitoring							x	
47	3	6	19	003N006E19D1	39-669	Irrigation	1950	116						
48	3	5	13	003N005E13M003M	101777	Irrigation	1965	102			x		x	
49	3	6	19			Domestic								
50	3	6	30	003N006E30G	47573	Domestic	1967	75						
51	3	6	30	003N006E30G	47555	Domestic	1967	60					x	
52	3	6	30	003N006E30G	47556	Domestic	1967	60						
53	3	5	14	003N005E14B	47546	Irrigation	1970	105					x	
54	3	5	27			Monitoring							x	
55	3	6	19	003N006E19C004M	44205	Irrigation	1968	152			x		x	
56	3	6	30	003N006E30	129421	Irrigation	1978	184					x	
57	3	6	19	003N006E19C003M	67177	Domestic	1961	120			x			
58	3	5	13	003N005E13E	270869	Irrigation	1989	153					x	
59	3	6	30			Monitoring							x	
60	3	5	13	003N00E13J	16346	Irrigation	1955	172					x	
61	3	6	30	003N006E30K001M		Other					x			
62	3	6	31	003N006E31E	71446	Irrigation	1980	400						
63	3	6	18	003N006E18M80	44924	Irrigation	1972	190					x	

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
64	3	6	18	003N006E18M	326910	Domestic	1989	175					x	
65	3	6	18	003N006E18M003M	47548	Irrigation	1970	96				x		
66	3	6	18	003N006E18M003M	412276	Domestic	1993	140		x		x	x	
67	3	6	18	003N006E18M	35794	Domestic	1960	87					x	
68	3	6	18	003N006E18M	44546	Domestic	1967	130					x	
69	3	6	18	003N006E18P	8544	Irrigation	1954	88				x		
70	3	6	18	003N006E18P	488272	Domestic	1992	209					x	
71	3	5	13	003N005E13D001M	39-650	Irrigation	1954	68						
72	3	6	18	003N006E18L80	334933	Domestic	1955	220					x	
73	3	5	35	003N005E35B	465226	Irrigation	1993	238						
74	3	6	18	003N006E18P004M	44901	Irrigation	1966	185			x	x		
75	3	6	30	003N006E30H	119258	Irrigation	1978	345					x	
76	3	5	14	003N005E14	761014	Monitoring	2003	150						
76	3	5	14	003N005E14	761015	Monitoring	2003	150						
76	3	5	14	003N005E14	761016	Monitoring	2003	150						
76	3	5	14	003N005E14	761017	Monitoring	2003	150						
76	3	5	14	003N005E14	761018	Monitoring	2003	150						
76	3	5	14	003N005E14	761019	Monitoring	2003	150						
77	3	6	19	003N006E19R80	101766	Domestic	1964	110						
78	3	5	13	003N005E13H001M	16340	Irrigation	1955	94			x		x	
79	3	5	14	003N005E14C001M		Irrigation				x			x	

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
80	3	6	18	003N006E18N80	73801	Domestic	1963	76						
81	3	6	18	003N006E18L80	73811	Domestic	1963	93						
82	3	5	14	003N005E14	569196	Municipal	1994	170					x	
83	3	6	31	003N006E31C1	43093	Irrigation	1971	170			x			
84	3	6	19			Monitoring							x	
85	3	5	13	003N005E13C001M	44978	Irrigation	1966	68			x		x	
86	3	5	14	003N005E14	E032798	Monitoring	2005	50						
86	3	5	14	003N005E14	E032799	Monitoring	2005	50						
86	3	5	14	003N005E14	E032800	Monitoring	2005	51						
86	3	5	14	003N005E14	E033357	Monitoring	2005	25						
86	3	5	14	003N005E14	E033358	Monitoring	2005	25						
87	3	5	14	003N005E14A	44887	Domestic	1967	51					x	
88	3	5	13	003N005E13B	495197	Industrial	1993	220						
89	3	6	19	003N006E19H80	78057	Domestic	1966	120					x	
90	3	6	19	003N006E19H	366333	Irrigation	1991	200					x	
91	3	6	18	003N006E18K80	45012	Irrigation	1977	98						
92	3	6	31	003N006E31	97949	Irrigation	1981	176						
93	3	6	20	003N006E20D002M		Irrigation				x			x	
94	3	5	13	003N005E13A	374051	Domestic	1991	186					x	
95	3	6	30	003N006E30R001M		Irrigation				x			x	
96	3	6	18	003N006E18R001M		Other					x			

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
97	3	5	36	003N005E36R001M		Other				x				
98	3	6	31	003N006E31N	39-685	Irrigation		105						
99	3	6	31	003N006E31H80	39-684	Domestic	1951	140						
100	3	5	13	003N005E13	119268	Irrigation	1978	190					x	
101	3	6	31	003N006E31N001M		Other				x				
102	3	6	29	003N006E29C001M		Irrigation				x				
103	3	6	31	003N006E31J	22652	Irrigation	1977	450			x			
104	3	6	20	003N006E20C006M		Other					x			
105	3	5	15	003N005E15E1	39-652	Domestic	1950	115						
106	3	6	20	003N006E20Q002M		Other					x			
107	3	6	20	003N006E20Q001M		Unused				x	x			
108	3	5	34	003N005E34N	547527	Domestic	1994	60				x	x	
109	3	6	29	003N006E29P002M		Other					x			
110	3	5	15	003N005E15D001	39-651	Domestic	1954	54		x			x	
N/A	3	5	24	003N005E24	44898	Irrigation	1987	114						
N/A	3	5	24	003N005E24	35778	Other	1958	34						
N/A	3	5	35	003N005E35C	498300	Domestic	1992	108						
N/A	3	5	13	003N005E13	73799	Domestic	1962	69						
N/A	3	5	13	003N005E13	742220	Irrigation	2001	68					x	
N/A	3	6	18	Illegible	16345	Irrigation	1955	117				x		
N/A	3	6	18	003N006E18	16341	Irrigation	1955	97				x		

TABLE B-1
Summary of Groundwater Wells in the Area of Review*

Map ID	Twp	Range	Section	State Well Number	Well Completion Report Number	Well Type	Year Drilled	Well Depth	Phase I Report	DWR	USGS	San Joaquin County	Lodi Groundwater Investigation	1994 Permit
N/A	3	6	31	003N006E31N	39-685	Irrigation		105						
N/A	3	4	25	003N005E25A	476403	Domestic	1997	60					x	
N/A	3	6	18	003N006318B002M	45030	Domestic	1978	96						
N/A	3	6	18	003N006E18H80	16334	Irrigation	1955	80				x	x	
N/A	3	6	18	003N006E18D80	35800	Irrigation	1961	109						
N/A	3	6	18	003N006E18D40	29059	Domestic	1978	120					x	
N/A	3	6	18	003N006E18H	45014	Domestic	1977	80						
N/A	3	6	18	003N006E18J80	47520	Domestic	1968	129					x	
N/A	3	6	18	003N006E18H	45032	Irrigation	1978	105						
N/A	3	6	18	003N006E18G008M	45013	Domestic	1977	95						
N/A	3	6	18	003N006E18K	19169	Domestic	1989	160					x	
N/A	3	6	18	003N006E18D	500624	Domestic	1996	155						

Note:

*Well locations are shown on Figure B-3

TABLE B-2
Summary of Deep Wells Drilled in and Near the Area of Review*

Well Name and Number	API No.	Twshp	Range	Section	Operator and Location	Well Type	Distance from Site (feet)	Drilling Completed	TD (feet)	Induction Log	Well History	Perf'ed Intervals	Present Status	Date Abandoned
Destroyed Wells within the Area of Review														
Federal Imeson #1	07700509	3N	5E	26	Federal Oil Co.	Dry Hole	2,252 (SW)	5/29/1955	4,875	X	X	N/A	Abandoned	05/30/1955
City of Lodi #1	07720290	3N	5E	24	Great Basins Petroleum Co.	Dry Hole	2,448 (NE)	11/30/1976	6,703	X	X	N/A	Abandoned	11/30/1976
Red House Fee # 65-24	07720496	3N	5E	24	Maxus Exploration Co.	Dry Hole	4,177 (NE)	7/7/1987	5,762	X	X	N/A	Abandoned	07/01/1987
Rio Blanco #1	07720172	3N	5E	27	Great Basins Petroleum Co.	Dry Hole	7,666 (WSW)	10/18/1972	5,450	X	X	N/A	Abandoned	10/18/1972
Buttes-Rio Blanco #15-77X	07720381	3N	5E	15	Argo Petroleum Corp.	Dry Hole	9,099 (NW)	10/23/1981	4,931	X	X	N/A	Abandoned	10/15/1981
Perrin #1	07700518	3N	6E	19	Ferguson & Bosworth	Dry Hole	10,090 (E)	12/18/1962	4,802	X	X	N/A	Abandoned	12/18/1962
Ratto #14-1	07720345	3N	5E	14	Venoco, Inc.	Dry Hole	10,428 (NNW)	11/4/1979	5,820	X	X	N/A	Abandoned	11/05/1979
Active Wells within the Area of Review														
Piacentine #1-27	07720484	3N	5E	27	Princeton Natural Gas, LLC	Gas	9,744 (WSW)	7/25/1985	4,900	X	X	4,701' – 4,730'	Producing Gas, Mokelumne Formation	
STIG-1	07720568	3N	5E	24	Northern California Power Agency	Injection			4,650	X	X	4,234 – 4,507	Injecting into Domengine Formation	
Destroyed Wells just outside the Area of Review														
CPC Hatche #31-1	07720456	3N	6E	31	Prima Oil & Gas Co.	Dry Hole	10,966 (SE)	3/9/1985	6,230	X	X	3,603 – 3,631	Abandoned	03/26/1985
Buttes-Fox #15-37X	07720379	3N	5E	15	Argo Petroleum Corp.	Dry Hole	10,987 (NW)	11/4/1981	5,000	X	X	N/A	Abandoned	11/04/1981
Klein #1-28	07700510	3N	5E	28	W.W. Holmes, Operator	Dry Hole	10,998 (WSW)	6/18/1961	5,702	X	X	N/A	Abandoned	06/19/1961
Moresco et al Unit A #1	07720469	3N	5E	28	Sierra Resources, Inc.	Gas Well	11,100 (WSW)	10/5/1985	6,500	X	X	4,698 – 4,760	Abandoned	08/01/1997

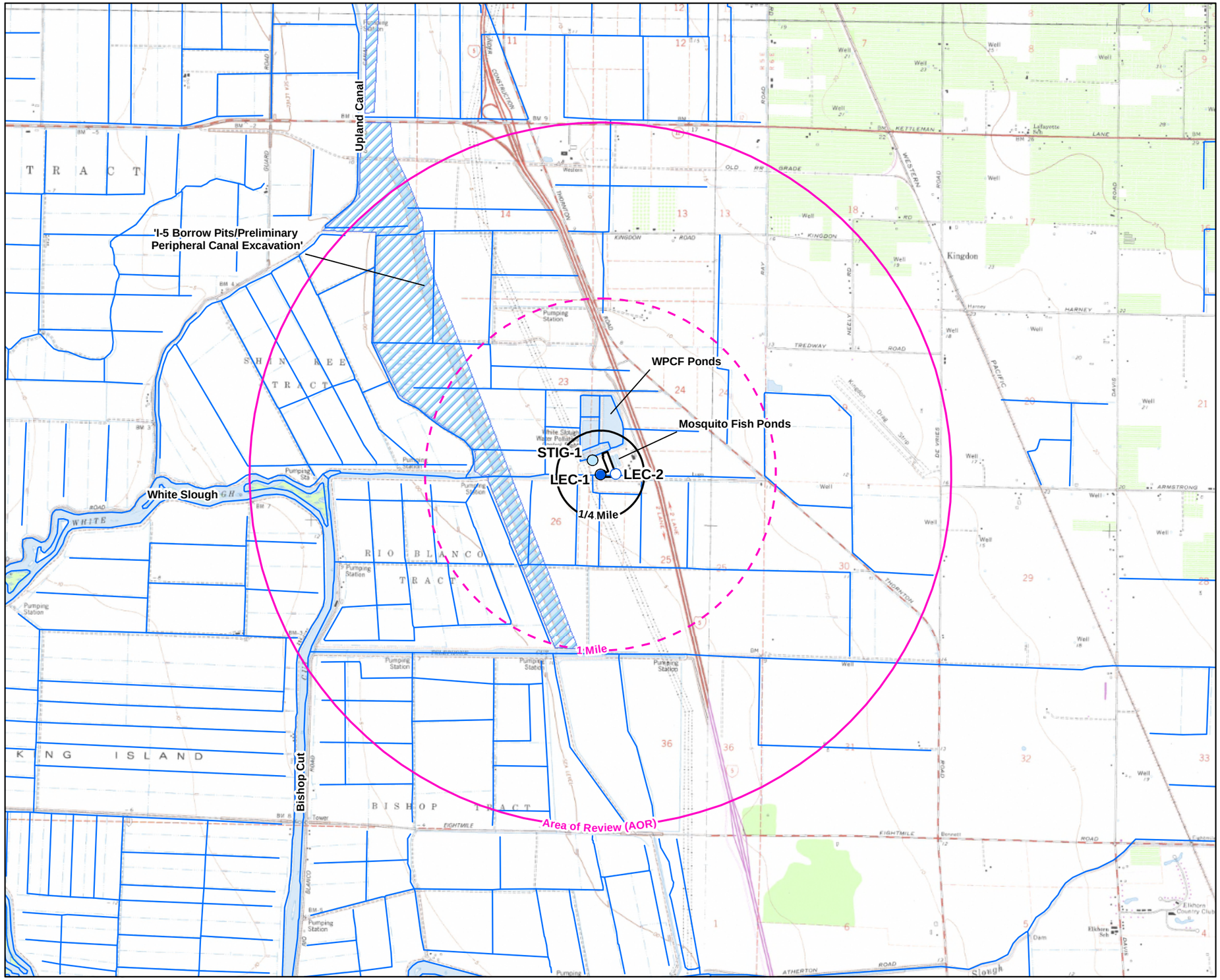
TABLE B-2
Summary of Deep Wells Drilled in and Near the Area of Review*

Well Name and Number	API No.	Twshp	Range	Section	Operator and Location	Well Type	Distance from Site (feet)	Drilling Completed	TD (feet)	Induction Log	Well History	Perf'ed Intervals	Present Status	Date Abandoned
Buttes-Coldani #15-44X	07720367	3N	5E	15	Argo Petroleum Corp.	Gas Well	11,551 (NW)	1/14/1981	6,015		X	N/A	Abandoned	05/20/1984
Coldani #CH-1	07700507	3N	5E	15	Amerada Hess Corp.	Dry Hole	11,558 (NW)	12/1/1952	4,912	X	X	N/A	Abandoned	12/01/1952
Argo-Buttes-Coldani #2-15	07720435	3N	5E	15	Western Continental Oper. Co.	Dry Hole	11,703 (NW)	6/3/1984	4,976	X	X	N/A	Abandoned	06/04/1984
Olagaray #1-20	07720488	3N	6E	20	Quintana Petroleum Corp.	Dry Hole	12,292 (E)	10/20/1986	5,850	X	X	N/A	Abandoned	10/21/1986

Note:

*Well locations are shown on Figure B-4.

Figures



LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)
- Ditches, Canals and Streams
- 1/4 Mile
- 1 Mile
- Area of Review (AOR) - 2 Miles
- White Slough Wildlife Area
- LEC Project Site

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE B-1
SURFACE WATER WITHIN THE AREA OF REVIEW
STIG-LEC FACILITY
LODI, CALIFORNIA

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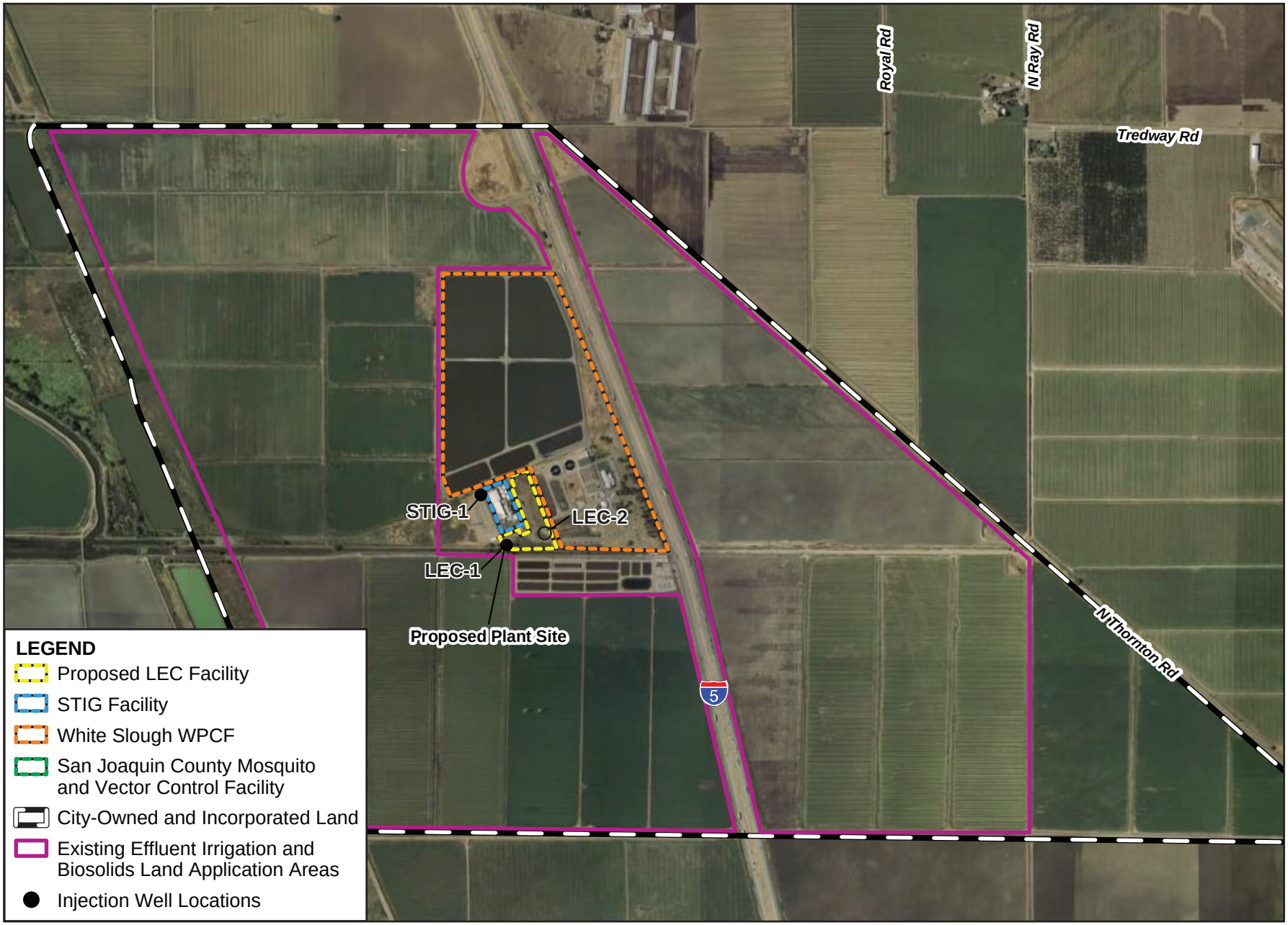

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

0 1,000 2,000
Feet

N

FIGURE B-2
SITE LOCATION
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL

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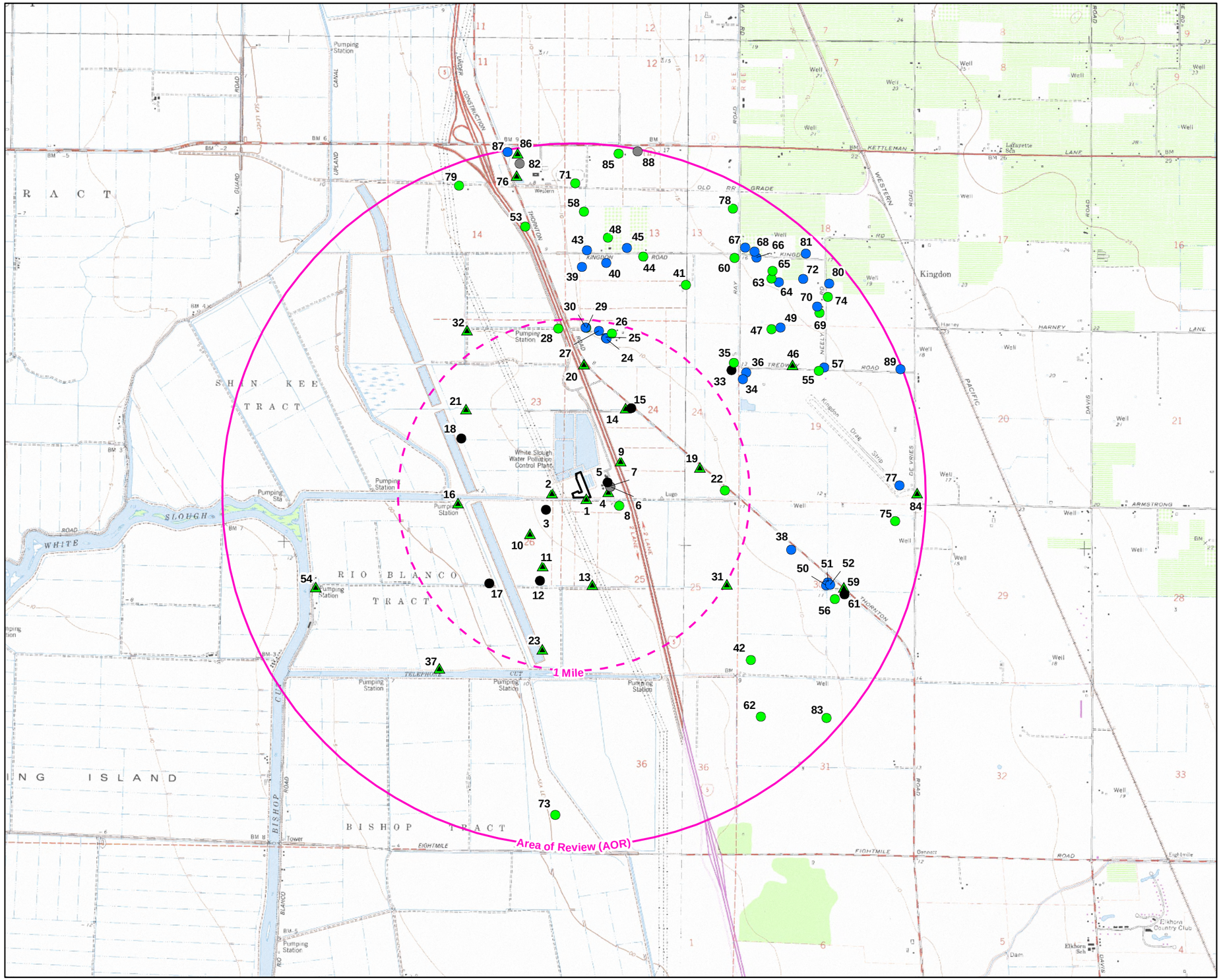

LEGEND

Well Types

- Domestic
- Industrial/Municipal
- Irrigation
- Monitoring
- Other

1 Mile

Area of Review (AOR) - 2 Miles

LEC Project Site

Notes:
1. Sources: California Department of Water Resources (DWR) (http://wdl.water.ca.gov/gw/),
Unites States Geological Survey (USGS)(http://water.usgs.gov/),
California DOGGR (http://www.conservation.ca.gov/dog/maps/Pages/goto_welllocation.aspx),
2006 City of Lodi Soil and Groundwater Investigation,
San Joaquin County (http://www.sjmap.org/groundwater/),
2008 Phase I Environmental Assessment for the NCPA LEC Project
1994 Permit to NCPA for STIG Well #1
Well Drilling Reports (within a 2 mile radius)

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE B-3
GROUND WATER WELLS IN THE AREA OF REVIEW
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

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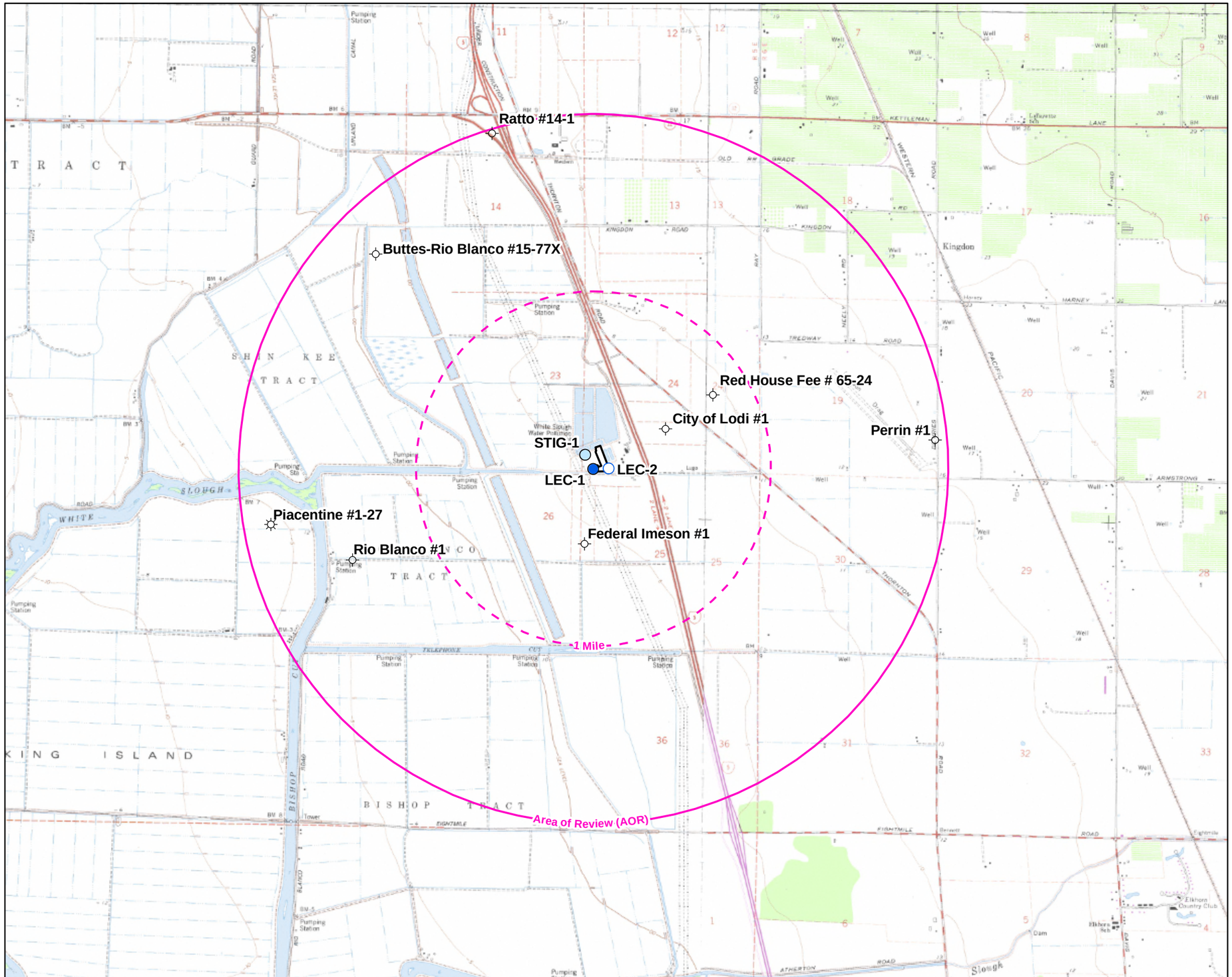

LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: California Department of Conservation (www.conservation.ca.gov/dog/maps/pages/goto_welllocation.aspx)

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE B-4
OIL AND GAS WELLS WITHIN THE AREA OF REVIEW
STIG-LEC FACILITY
LODI, CALIFORNIA

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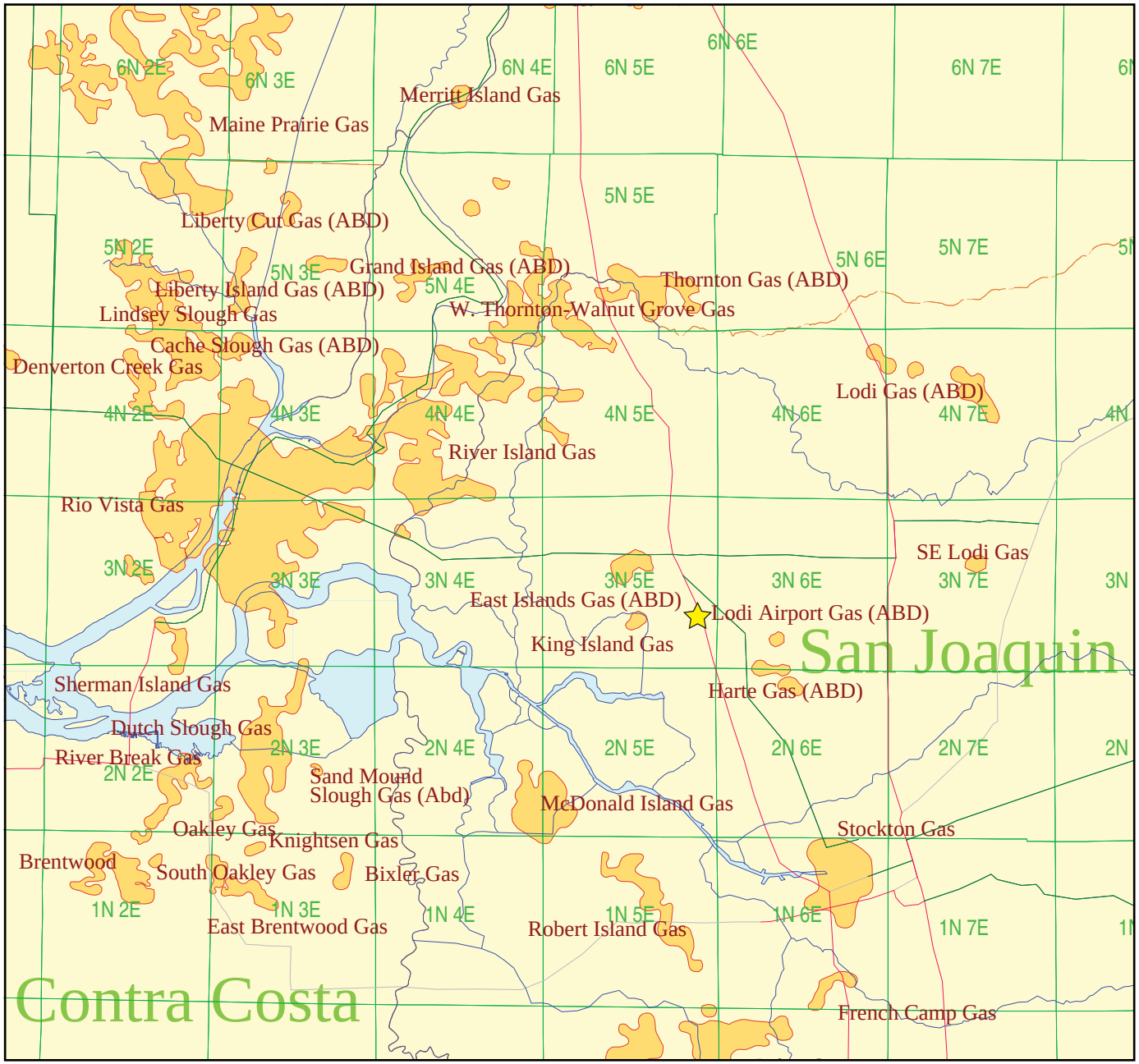


STIG-LEC Facility

Source:
California Department of Conservation, June 1999

FIGURE B-5
LOCATION OF GAS FIELDS
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Attachment C
Corrective Action Plan and Well Data

Application Requirements

Submit a tabulation of data reasonably available from public records or otherwise known to the applicant on all wells within the AOR, including those on the map required in Attachment B, which penetrate the proposed injection zone. Such data shall include the following:

Class I— A description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the director may require. In the case of new injection wells, include the corrective action proposed to be taken by the applicant under 40 Code of Federal Regulations (CFR) 144.55.

Approach

The Correction Action Plan addresses the deep wells within the AOR defined jointly for the STIG-1, LEC-1, and LEC-2 wells.

Corrective Action Plan and Well Data

Figure C-1 is a map of the known wells that have been drilled within the 2-mile AOR that penetrate the Domengine Formation. This compilation of wells is based on the information obtained from the DOGGR Web site (DOGGR, 2008b). This is the same group of gas wells identified in the STIG-1 1993 permit application[1]. The only additional deep well installed in the area since 1993 is the STIG-1 well itself.

Nine wells, including STIG-1, have been drilled within the AOR that penetrated the Domegine Formation injection zone. Information from these wells and their abandonment is summarized in Table C-1. Three of these occur within 1 mile of the facilities. They are:

- Great Basins City of Lodi #1
- Federal Imeson #1
- Maxus Red House Fee #65-24

Well abandonment records for the wells within the AOR, filed with the DOGGR (formerly the California Division of Oil and Gas) are provided in Appendix 4. These records indicate that the wells were abandoned following required guidelines, and that the plugging operations were witnessed, reported, and approved in every case by the DOGGR representative. Consequently, no further corrective action plan is presented. Schematics of the deep wells within the AOR are shown in Figure C-2.

[1] The STIG-1 application provided information on wells within a 2-mile study area, even though the AOR was 1 mile.

Only one of the wells drilled within the AOR is actively producing hydrocarbons. The Quintana Piacentine #1-27 (located approximately 1 ¾ miles west of the STIG-1 well) produces gas from the Mokelumne Formation. The Mokelumne Formation is just below the Capay Shale, which is the lower confining zone for the STIG well. Information available on the DOGGR Web site is also provided for this well in Appendix 4.

To confirm that the injection at the STIG-LEC facility would not compromise any of the existing deep wells within the AOR, an assessment of the change in pressure at each well was conducted. These results are shown in Table C-2 and Figure C-3.

The closest well, City of Lodi #1, is approximately 1,840 feet from the injection site. This well was plugged back at the base of the surface casing. Hydrostatic pressure of the abandonment mud was reported as 75 lb/ft^3. The pressure applied at 4,100 feet by the mud is approximately 345 psi greater than hydrostatic. At 1,840 feet, the pressure increase due to injection is shown by Table C-2 to be less than 200 psi. This suggests that even without the cement plugs in place, the mud pressure more than balance the increase in pressure expected due to injection operations. Similar calculations are provided in Table C-2 for the other wells in the AOR.

In summary, within the 2-mile AOR there are only two known existing gas wells, injection wells, or other wells for any other purpose that penetrate the confining layer above the proposed injection zone that have not been properly destroyed. These are an active gas well and the active STIG-1 injection well.

TABLE C-1
Summary of Deep Wells Drilled in and Near the Area of Review*

Well Name and Number	API No.	Twnshp	Range	Section	Operator and Location	Well Type	Distance from Site (feet)	Drilling Completed	TD (feet)	Induction Log	Well History	Perf'ed Intervals	Present Status	Date Abandoned
Abandoned Wells within the Area of Review														
Federal Imeson #1	07700509	3N	5E	26	Federal Oil Co.	Dry Hole	2,252 (SW)	5/29/1955	4,875	X	X	N/A	Abandoned	05/30/1955
City of Lodi #1	07720290	3N	5E	24	Great Basins Petroleum Co.	Dry Hole	2,448 (NE)	11/30/1976	6,703	X	X	N/A	Abandoned	11/30/1976
Red House Fee # 65-24	07720496	3N	5E	24	Maxus Exploration Co.	Dry Hole	4,177 (NE)	7/7/1987	5,762	X	X	N/A	Abandoned	07/01/1987
Rio Blanco #1	07720172	3N	5E	27	Great Basins Petroleum Co.	Dry Hole	7,666 (WSW)	10/18/1972	5,450	X	X	N/A	Abandoned	10/18/1972
Buttes-Rio Blanco #15-77X	07720381	3N	5E	15	Argo Petroleum Corp.	Dry Hole	9,099 (NW)	10/23/1981	4,931	X	X	N/A	Abandoned	10/15/1981
Perrin #1	07700518	3N	6E	19	Ferguson & Bosworth	Dry Hole	10,090 (E)	12/18/1962	4,802	X	X	N/A	Abandoned	12/18/1962
Ratto #14-1	07720345	3N	5E	14	Venoco, Inc.	Dry Hole	10,428 (NNW)	11/4/1979	5,820	X	X	N/A	Abandoned	11/05/1979
Active Wells within the Area of Review														
Piacentine #1-27	07720484	3N	5E	27	Princeton Natural Gas, LLC	Gas	9,744 (WSW)	7/25/1985	4,900	X	X	4,701' – 4,730'	Producing Gas, Mokelumne Formation	
STIG-1	07720568	3N	5E	24	Northern California Power Agency	Injection			4,650	X	X	4,234 – 4,507	Injecting into Domengine Formation	

Note:

*Well locations are shown on Figure B-4.

TABLE C-2
Pressure Changes at Deep Wells Within the AOR Resulting from Injection at STIG-1 and LEC-1

API Number	Operator	Lease	Well Number	Distance to STIG-LEC Facility	Pressure Increase (PSI)		Reservoir Pressure (PSI)		Mud Weight (ppg)[1]	Hydrostatic Pressure Required to Mobilize Fluid (psi)[2]	Excess Hydrostatic Pressure (psi)
					10 years	30 years	10 years	30 years			
7720290	Great Basins Petroleum Co.	City of Lodi	1	1,848	279	328	2,058	2,107	10.0	2,167	60
7700509	Federal Oil Co.	Federal Imeson	1	2,587	250	298	2,029	2,077	10.8	2,337	260
7720496	Maxus Exploration Co.	Red House Fee	65-24	3,749	217	266	1,995	2,045	9.8	2,124	79
7720172	Great Basins Petroleum Co.	Rio Blanco	1	7,392	158	206	1,937	1,985	10.4	2,252	267
7720484	Princeton Natural Gas, LLC	Piacentine	1-27	8,448	146	194	1,925	1,973	9.6	2,081	108
7720381	Argo Petroleum Corp.	Buttes-Rio Blanco	15-77X	8,873	142	190	1,921	1,969	9.9	2,145	176
7720345	Venoco, Inc.	Ratto	14-1	9,504	136	184	1,915	1,963	10.0	2,167	204
7700518	Ferguson & Bosworth	Perrin	1	10,032	131	179	1,910	1,958	10.4	2,248	290
7720568	Northern California Power Agency	Lodi STIG	1	0							

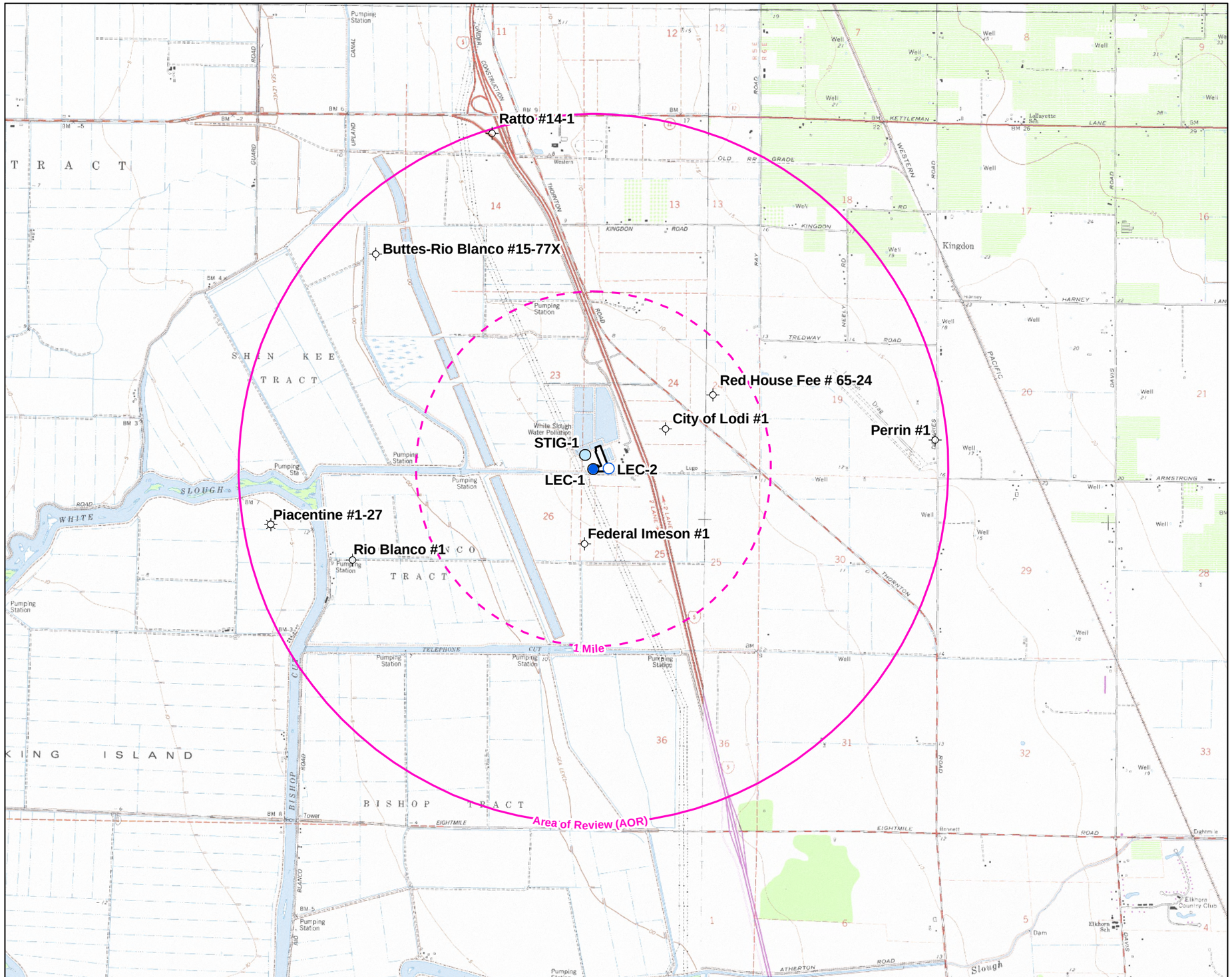
Notes:

Data from the DOGGR website well history files.

[1] Mud weight based on information from geophysical log headers

[2] Hydrostatic pressure based on 4,100 ft column of fluid

Figures



LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: California Department of Conservation (www.conservation.ca.gov/dog/maps/pages/goto_welllocation.aspx)

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE C-1
OIL AND GAS WELLS WITHIN THE AREA OF REVIEW
STIG-LEC FACILITY
LODI, CALIFORNIA

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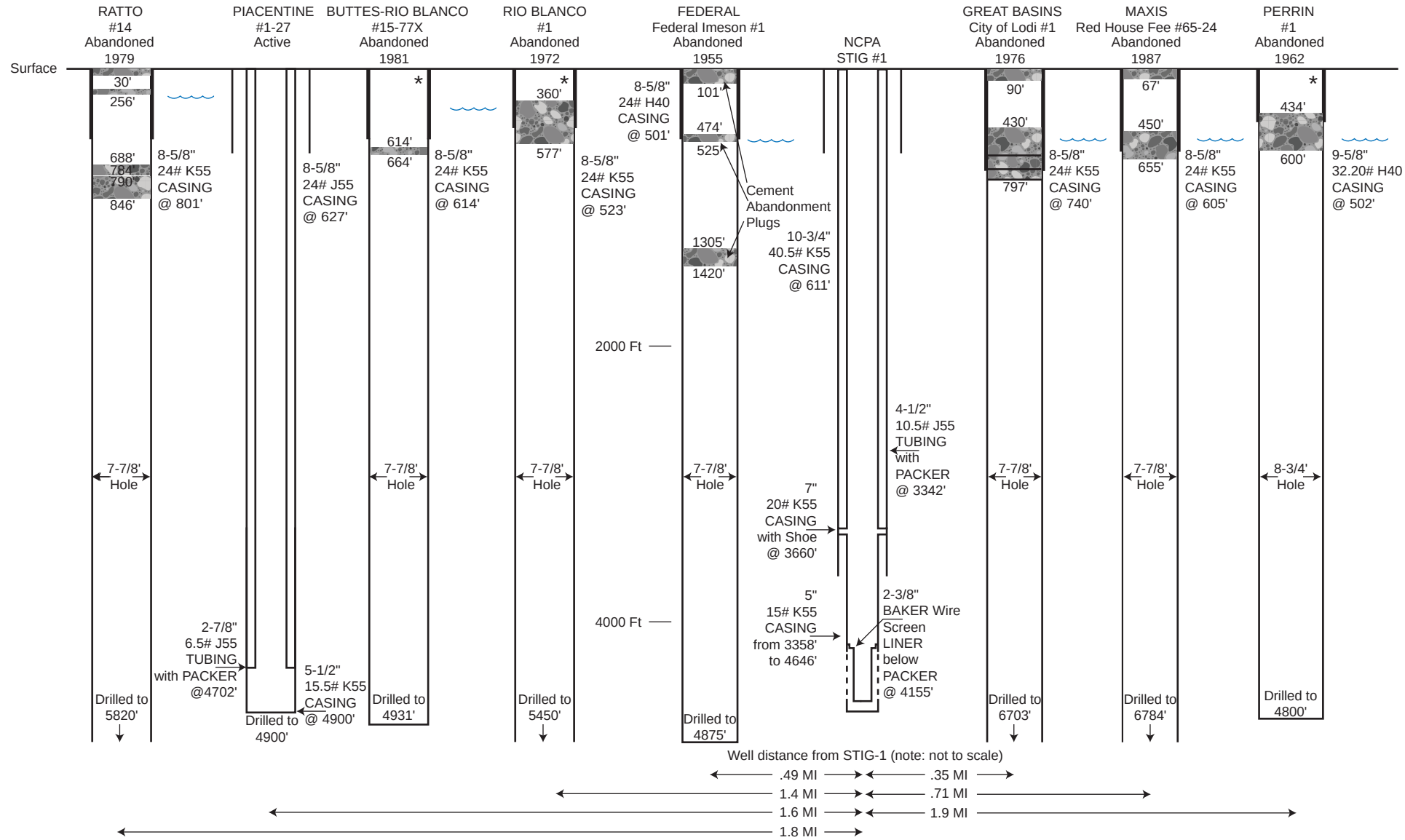

Approximate Base of Fresh Water as determined by well records obtained from DOGGR.

* Surface seal information not listed in well records.

Source:
After Northern California Power Agency, May 1993 for wells within 1 mile radius
Information from DOGGR website (www.consrv.ca.gov/dog) used to construct wellbore schematics

FIGURE C-2
WELLBORE SCHEMATICS OF THE ABANDONED EXPLORATORY GAS WELLS IN THE AREA OF REVIEW
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

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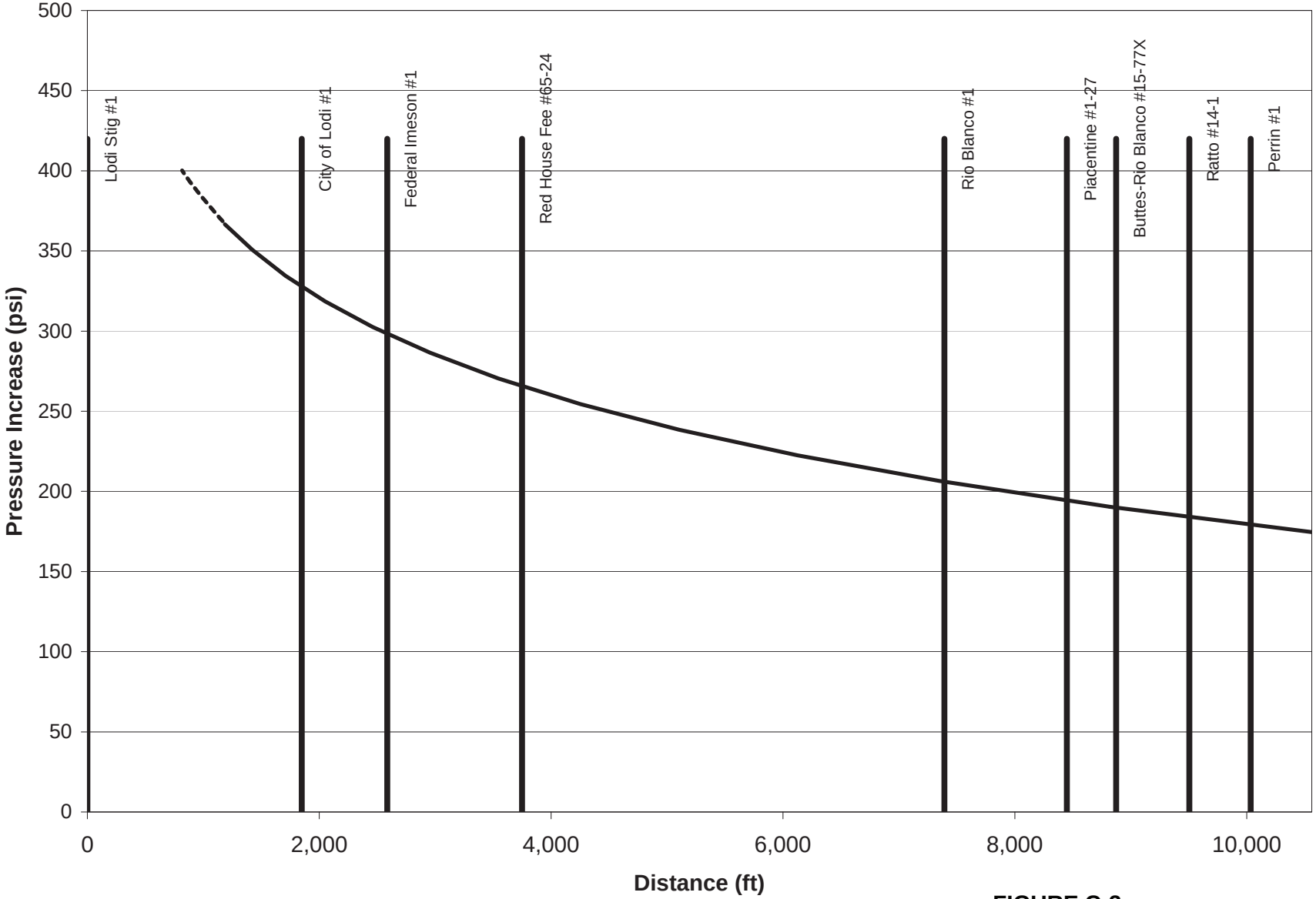


FIGURE C-3
30-YEAR CHANGE IN PRESSURE AT EACH EXISTING DEEP WELL
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Attachment D
Map and Cross Sections of USDWs

Application Requirements

Submit maps and cross sections indicating the vertical limits of all underground sources of drinking water within the AOR (both vertical and lateral limits for Class I); their position relative to the injection formation; and the direction of water movement, where known, in every underground source of drinking water that may be affected by the proposed injection.

Approach

This section focuses on potable groundwater conditions near the STIG-LEC facility. The geologic information contained in Attachment D of the original 1993 permit application has been moved to Attachment F.

Geologic and Hydrogeologic Setting

Northern San Joaquin County is located in the Central Valley, and is considered the northernmost portion of the San Joaquin Valley. The STIG-LEC facility is located in the portion of the Central Valley referred to as the Sacramento-San Joaquin River Delta (Delta) (Figure D-1). In the Delta, the confluence of the Sacramento and San Joaquin rivers is influenced by tidal action to produce a biologically-rich estuarine environment. Additionally, the Delta has been highly modified by channelization and water diversions for municipal, industrial, and agricultural uses, resulting in a patchwork of islands and tracts surrounded by natural and man-made channels and sloughs. An extensive levee system protects most Delta islands because they are now below sea level as a result of subsidence.

Geologic History

The Central Valley is underlain by thousands of feet of sediment deposited in shallow marine and continental environments. Beginning during the late Jurassic Period (150 to 175 million years before present), the Central Valley was a large inland sea receiving sediment input both from the rising Sierra Nevada to the east and the Coast Ranges to the west. Influx of sediments occurred from erosion of the surrounding uplands, regional volcanic activity, and marine influences possibly from multiple openings to the ocean. During the Pliocene Epoch (1.8 to 5 million years before present), the inland sea drained through the Carquinez Straits, and the local environment was dominated by brackish and freshwater lakes (Norris and Webb, 1990).

The Central Valley is now dominated by a series of rivers that primarily drain the Sierra Nevada, and to a lesser extent, the Coast Ranges. These rivers empty into either the

Sacramento or San Joaquin rivers, the major rivers that drain the Sacramento and San Joaquin Valleys, and exit the valley at the Delta.

Hydrogeology

The groundwater system within the Central Valley is subdivided into subbasins, commonly based on surface water drainage that influences the underlying water flow. The STIG-LEC facility is within the Eastern San Joaquin Subbasin portion of the San Joaquin Valley Groundwater Basin (DWR, 2006) (Figure D-2). The Eastern San Joaquin Subbasin is bounded by the Mokelumne River on the north and northwest, San Joaquin River on the west, Stanislaus River on the south, and consolidated bedrock of the Sierra Nevada on the east. The Eastern San Joaquin Subbasin is drained by the San Joaquin River and several major tributaries, including the Stanislaus, Mokelumne, and Calaveras rivers.

Although groundwater levels in the Eastern San Joaquin Subbasin have shown a steady decline over the past 40 years, groundwater conditions near the STIG-LEC facility have remained fairly stable (Figure D-3). During this period, groundwater levels in other portions of the Eastern San Joaquin Subbasin have declined at an average rate of 1.7 feet per year, and have dropped as much as 100 feet in some areas (DWR, 2006). Well yields in the fresh water-bearing formation underlying the subbasin range from approximately 650 to 1,500 gpm (DWR, 2006). Saltwater intrusion occurring in the Stockton area has caused water quality to deteriorate eastward along a 16-mile front on the east side of the Delta. In addition, large areas of elevated nitrate levels exist in groundwater supplies within the subbasin located southeast of Lodi (DWR, 2006). Representative concentrations of typical groundwater constituents are shown in Table D-1.

TABLE D-1
Groundwater Quality in the Vicinity of the LEC Project Site

Constituent	Quantity
Total Dissolved Solids	600-700 mg/L
Calcium, Magnesium	40 mg/L
Chlorine	10-20 mg/L
Sulfate	5 mg/L
Sodium, Potassium	60-70 mg/L
Bicarbonate, Carbonate	60-70 mg/L

Source: AFC, 2008

Domestic wells in the Eastern San Joaquin Subbasin range from approximately 25 to 993 feet in depth, averaging approximately 242 feet (DWR, 2006). Irrigation wells in the subbasin range from approximately 75 to 780 feet in depth, averaging approximately 349 feet (DWR, 2006).

Regionally, the direction and magnitude of the hydrologic gradient are controlled by a pumping cone depression around the City of Stockton that persists throughout the year (Figure D-4) (City of Lodi, 2006). Locally, groundwater use for irrigation is higher to the east of the STIG-LEC facility project site resulting in a local gradient that is consistently to the

east (City of Lodi, 2006). As a result, groundwater in the vicinity of the STIG-LEC facility flows generally from west to east (Figure D-5). The higher groundwater use to the east of the STIG-LEC facility is evident by the higher number of wells to the east of I-5, as shown in Figure D-6.

Groundwater elevations in the vicinity of the STIG-LEC facility project site fluctuate seasonally and in response to annual precipitation variation (City of Lodi, 2006). Groundwater fluctuations are lower to the west of the LEC project site because the Delta is subject to less groundwater pumping and provides more uniform recharge throughout the year. Groundwater elevations at production wells in the vicinity of the LEC project site typically fluctuate by up to approximately 10 feet annually (City of Lodi, 2006) and are also affected by local groundwater pumping (see Figure D-4). Figure D-6 shows the identified wells within the 2 mile AOR of the STIG-LEC project site. The primary uses of groundwater in the area are for agricultural and domestic supply.

Source of groundwater recharge in the vicinity of the STIG-LEC facility, in addition to precipitation, include irrigation of Delta lands and seepage from related Delta waterways to the west, surface-water-irrigated lands to the north and east, percolation from WPCF storage ponds, and recharge from WPCF land application areas (City of Lodi, 2006).

Potable Aquifers

The Tertiary and Quaternary deposits that comprise the local potable aquifers are, from oldest to youngest, the Valley Springs, Mehrten, Laguna, Turlock Lake (formerly referred to as the Victor Formation), Riverbank, and Modesto formations. These alluvial and fluvial sediments were associated with tectonic uplift of the Sierra Nevada and were deposited into the subsiding structural trough of the Central Valley. Saline water occurs within the Late Cretaceous to Eocene sediments and rock (City of Lodi, 2006). Regionally or locally extensive confining layers do not occur between or within these units in the STIG-LEC facility, and consequently, these aquifers are unconfined. Figure D-7 shows a cross-section of the potable aquifers in the Stockton area.

Several groundwater investigations have occurred near the White Slough WPCF to assess the impacts of the facility's percolation ponds on underlying shallow groundwater (City of Lodi, 2006). A network of 22 monitoring wells has been installed to support this investigation. Two groundwater investigations are also occurring at the Highway 12/I-5 commercial area, referred to informally as Flag City.

Groundwater levels near the facilities occur at depths that are less than 10 feet bgs.

Underground Sources of Drinking Water

USDW are defined (40 CFR 144.3) as any aquifer capable of supplying a public water system with water of less than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS). Local studies evaluating the USDW underlying the STIG-LEC facility were not identified. However, two studies assessing the base of the fresh water aquifer, defined as water having a TDS value of 3,000 mg/L or less, have been conducted for the area. This information is presented here because it is the general depth targeted for well plug installation during

deep well abandonment, and it provides a record of the interval targeted for protection by state and local agencies.

The primary sources of groundwater in the STIG-LEC facility are the Tertiary and Quaternary shallow non-marine sediments identified previously. When the original STIG-1 permit was prepared, California Division of Oil and Gas (CDOG [now DOGGR]) estimated the fresh water base, defined as 3,000 mg/L TDS, to be at an elevation of 450 feet. Two regional assessments of the base of the fresh-water aquifer (Figure D-8) support that estimate. This is consistent with the depth of the existing domestic and irrigation wells in the area.

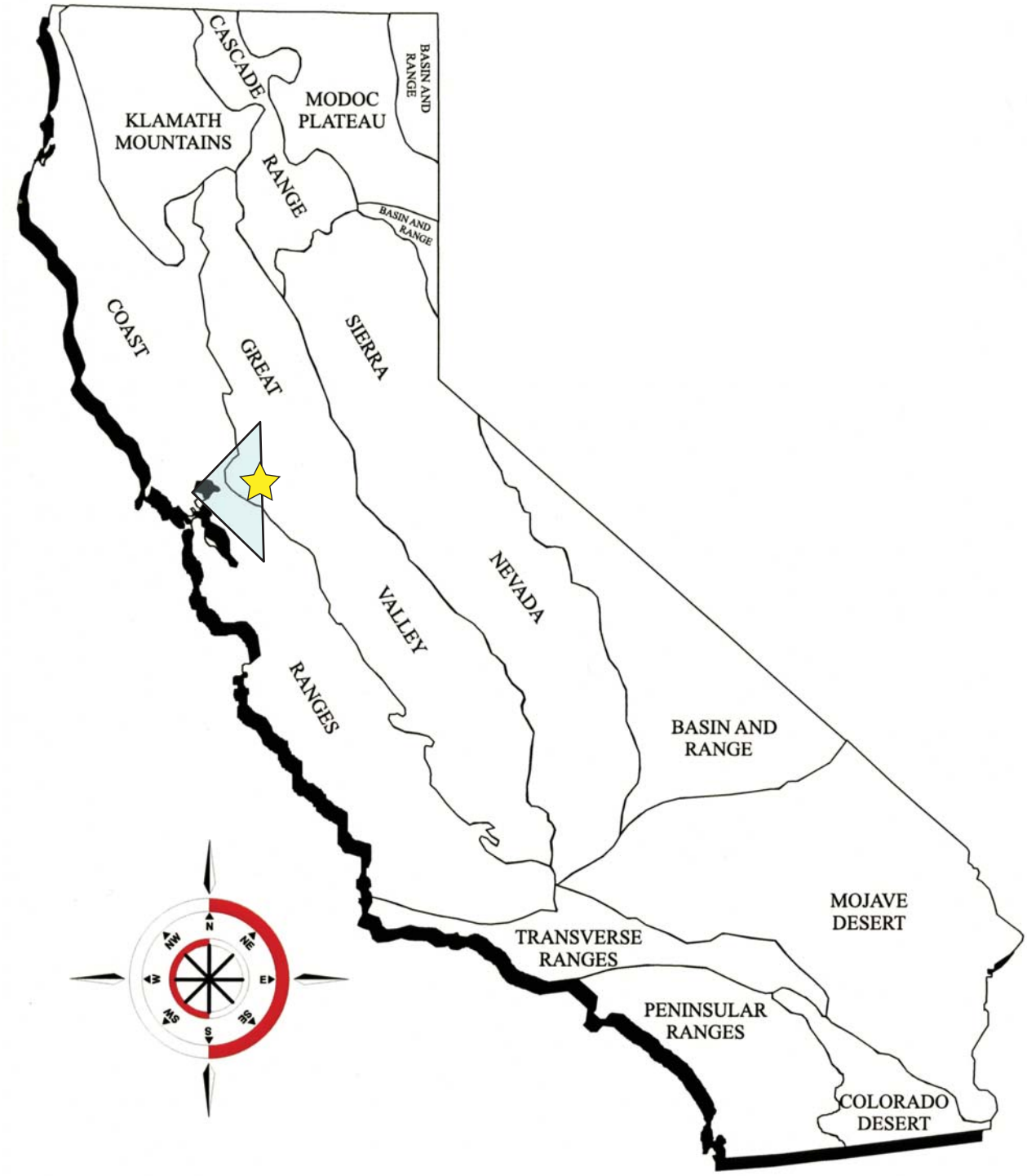
TDS Changes with Depth

A vertical profile of the salinity changes in the units penetrated by the STIG-1 well was prepared for the original 1993 permit (Figure D-9). The profile was created by:

- Chemical analysis of the formation waters sampled from the proposed Domengine Formation injection interval (4,234 to 4,507 feet).
- Evaluation of geophysical logs for eleven permeable intervals that occur from ground surface to the bottom of the Domengine Formation, performed by Halliburton Logging Services.
- CDOG (now the DOGGR) estimated depth of the 3,000 mg/L TDS.
- Chemical analysis of shallow groundwater

This profile indicates that the base of the USDW at the STIG-LEC facility is either the base of the Markley formation or the Nortonville shale. Each of the samples collected from the Domengine Formation prior to injection indicates that it is below the USDW. Although different methods were used to estimate or determine salinity values in the vertical profile, there is agreement between two approaches that obtained salinity values from similar intervals within the Domengine Formation. An estimated value of 14,000 mg/L sodium chloride (NaCl) was obtained from log-derived salinity methods for the 4,270- to 4,300-foot interval, which is the upper portion of the injection interval. This compares favorably with the laboratory-derived value of 14,066 mg/L from the 4,234 to 4,507 foot interval.

Figures

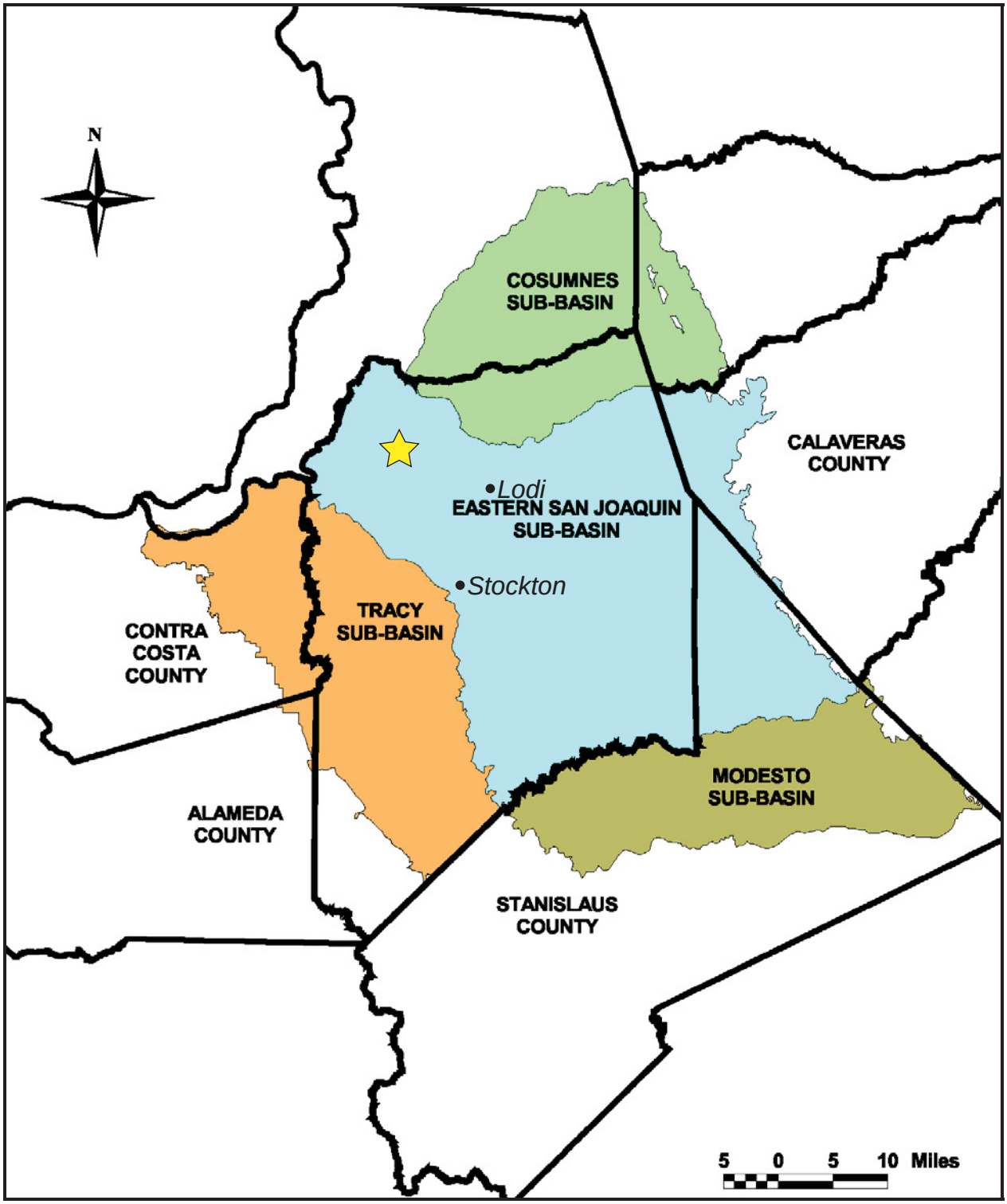


STIG-LEC Facility

General Area referred to as 'The Delta'

Source:
California Geological Survey 2002

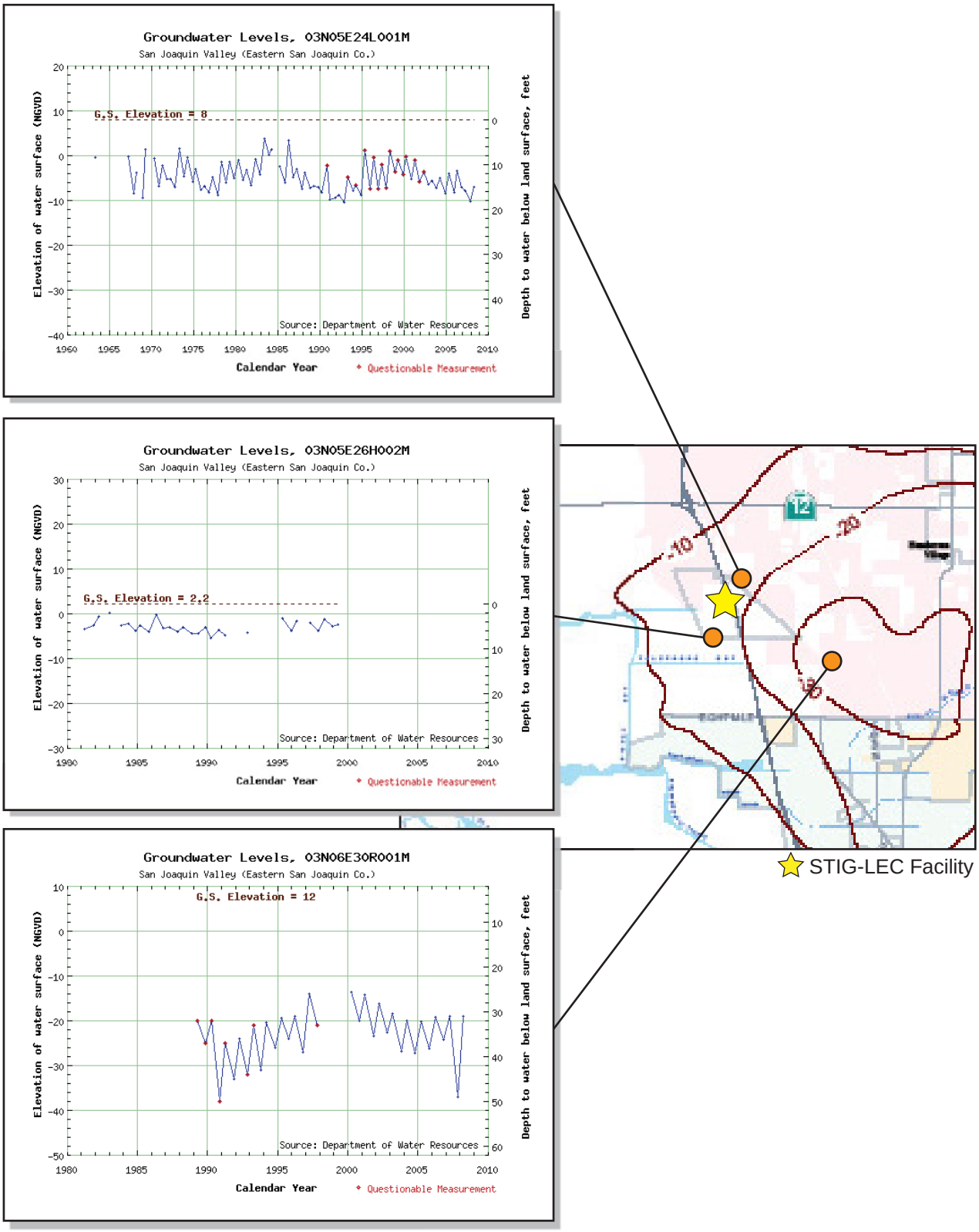
FIGURE D-1
CALIFORNIA GEOMORPHIC PROVINCES
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



STIG-LEC Facility

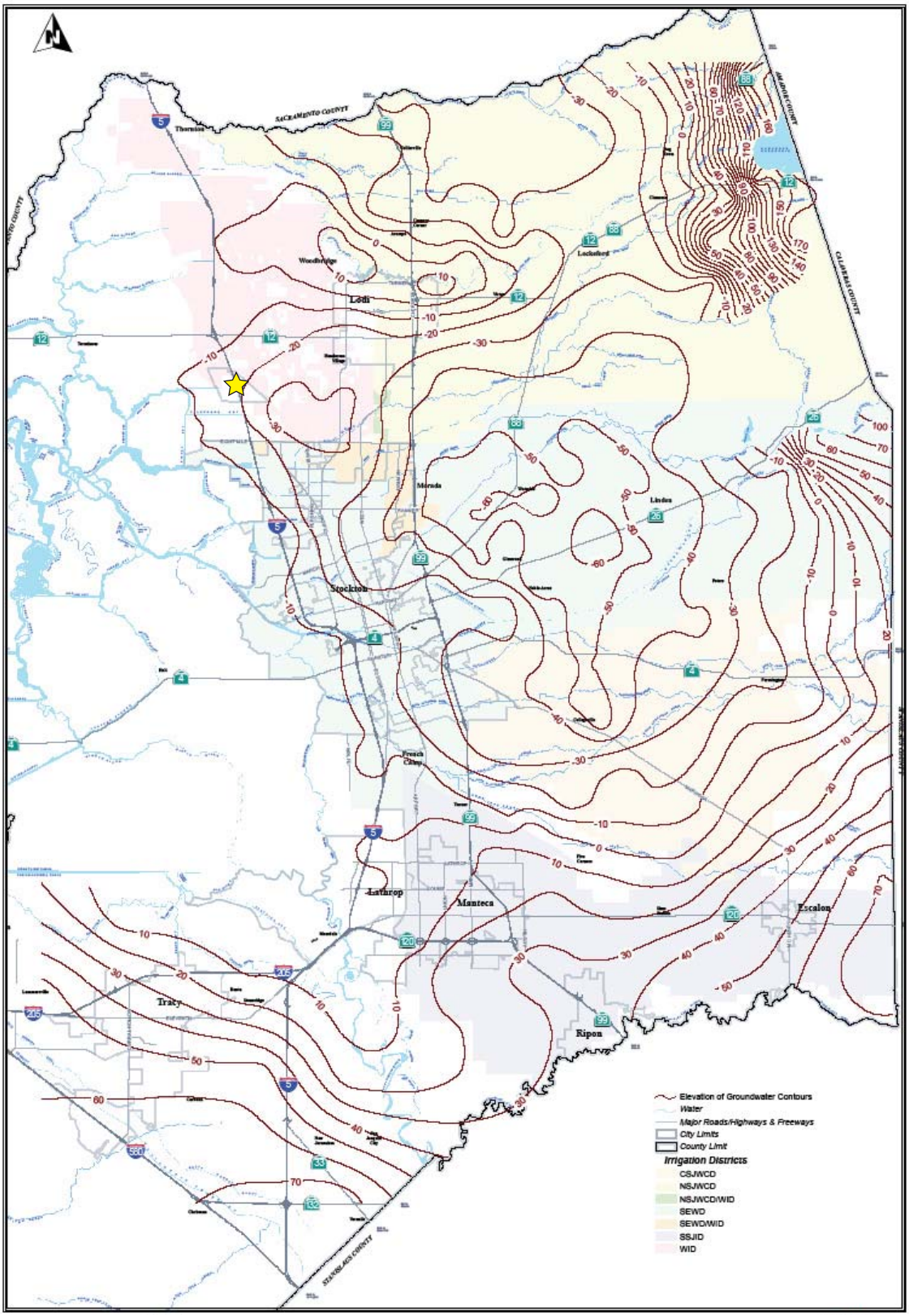
FIGURE D-2
GROUNDWATER SUBBASINS IN THE SAN JOAQUIN COUNTY AREA
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Source:
San Joaquin County Department of Public Works, 2004



Source:
California Department of Water Resources Website

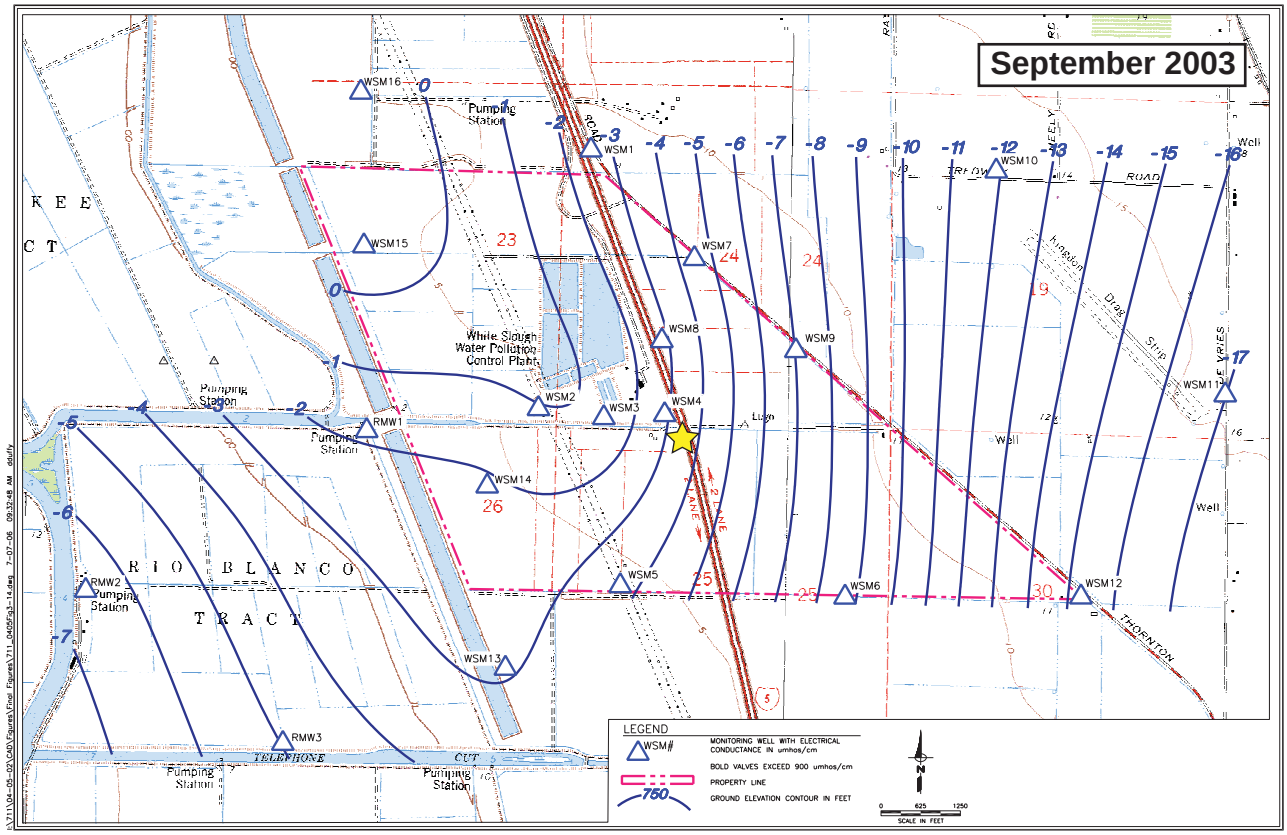
FIGURE D-3
LONG-TERM GROUNDWATER LEVEL CHANGES IN THE STIG-LEC AREA
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

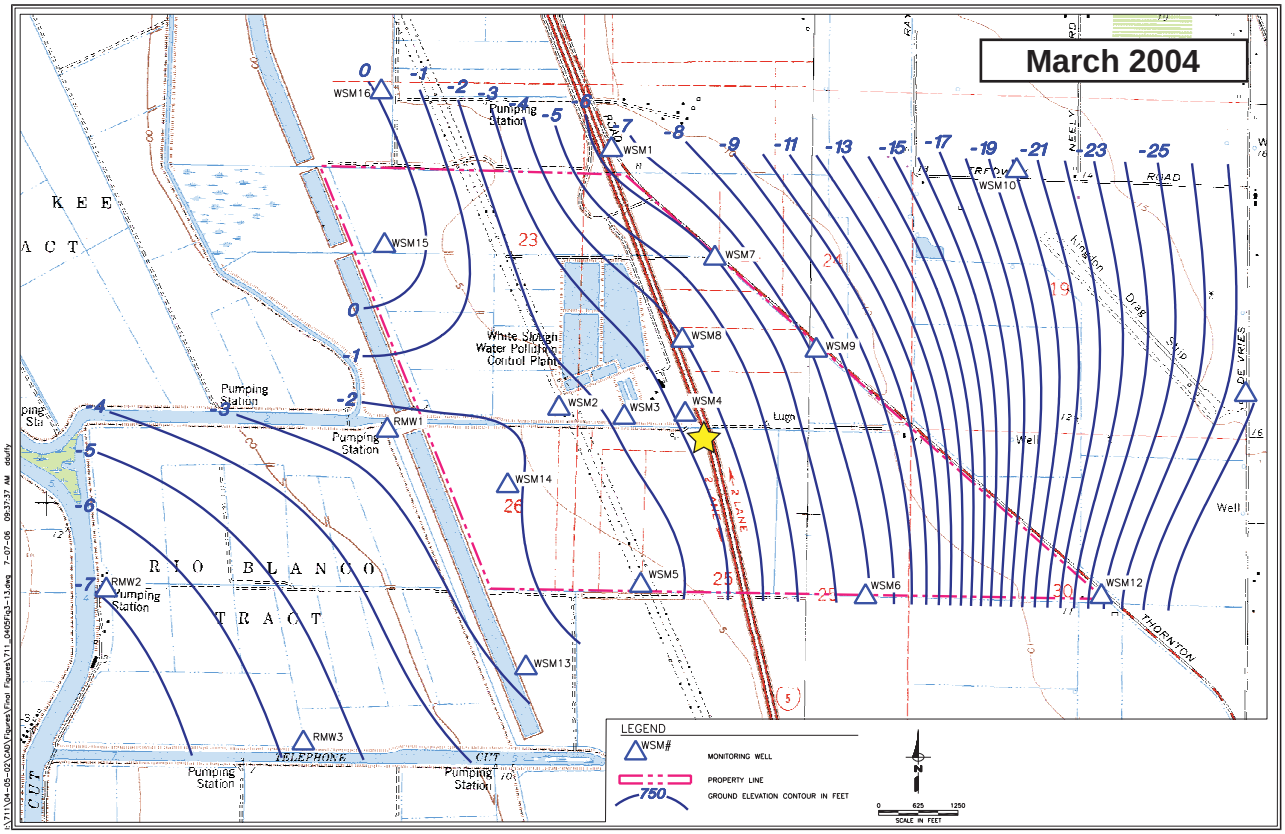


STIG-LEC Facility

Source:
San Joaquin County Department of Public Works, 2008

FIGURE D-4
REGIONAL GROUNDWATER ELEVATIONS IN FALL OF 2007
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

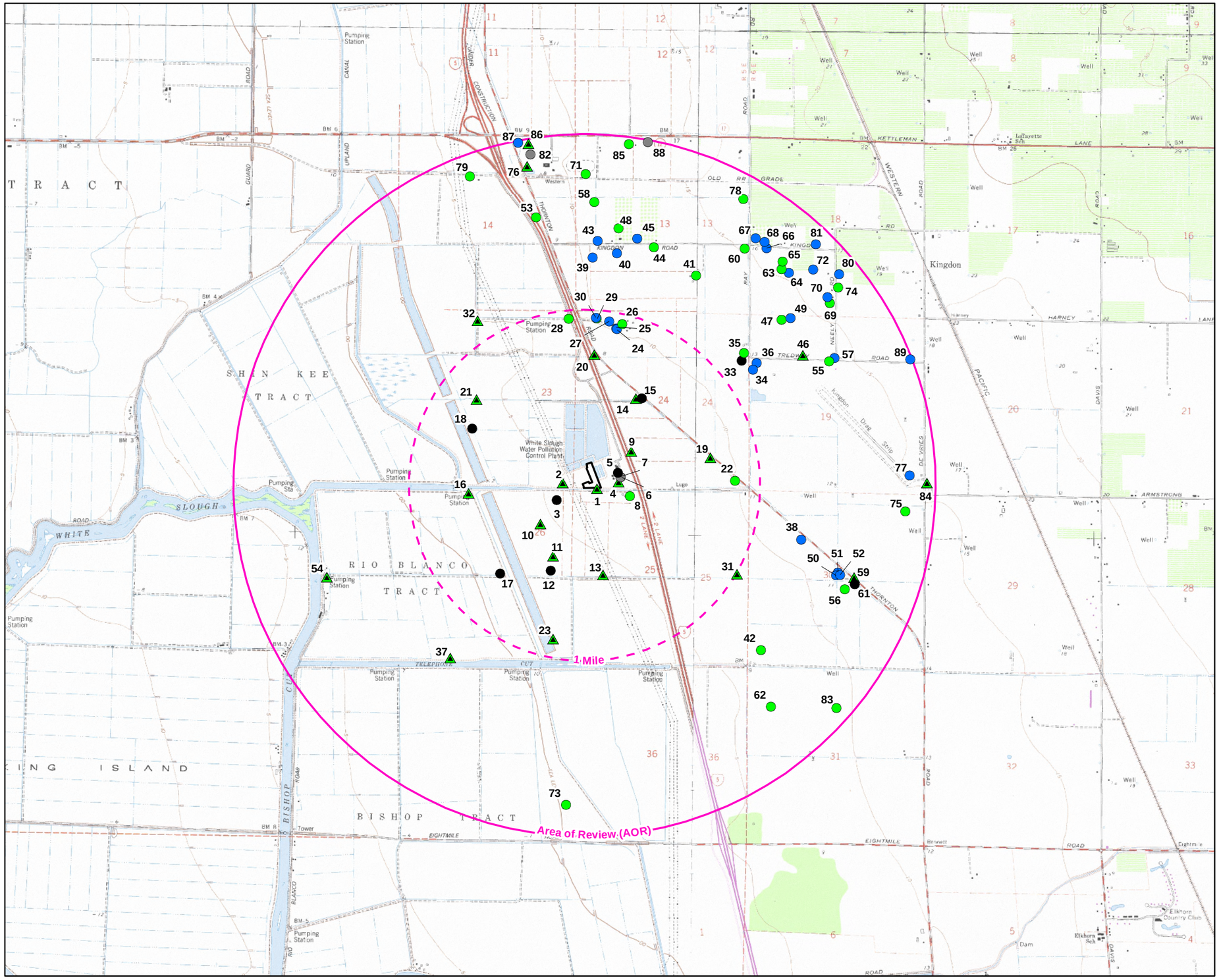




STIG-LEC Facility

Source:
City of Lodi, 2006

FIGURE D-5
LOCAL GROUNDWATER CONTOURS IN SEPTEMBER 2003 AND MARCH 2004
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



LEGEND

Well Types

- Domestic
- Industrial/Municipal
- Irrigation
- Monitoring
- Other/Unused
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: California Department of Water Resources (DWR) (http://wdl.water.ca.gov/gw/), Unites States Geological Survey (USGS) (http://water.usgs.gov/), California DOGGR (http://www.conservation.ca.gov/dog/maps/Pages/goto_welllocation.aspx), 2006 City of Lodi Soil and Groundwater Investigation, San Joaquin County (http://www.sjmap.org/groundwater/), 2008 Phase I Environmental Assessment for the NCPA LEC Project 1994 Permit to NCPA for STIG Well #1 Well Drilling Reports (within a 2 mile radius)

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

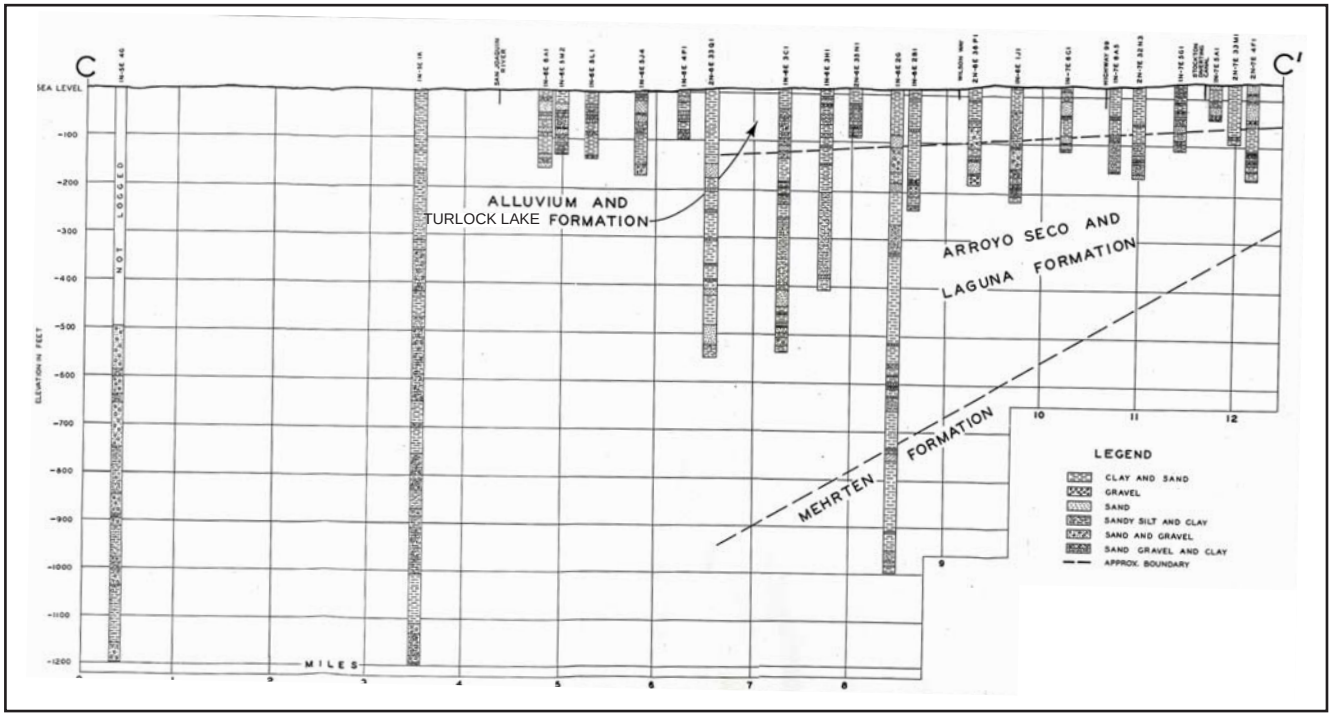
N

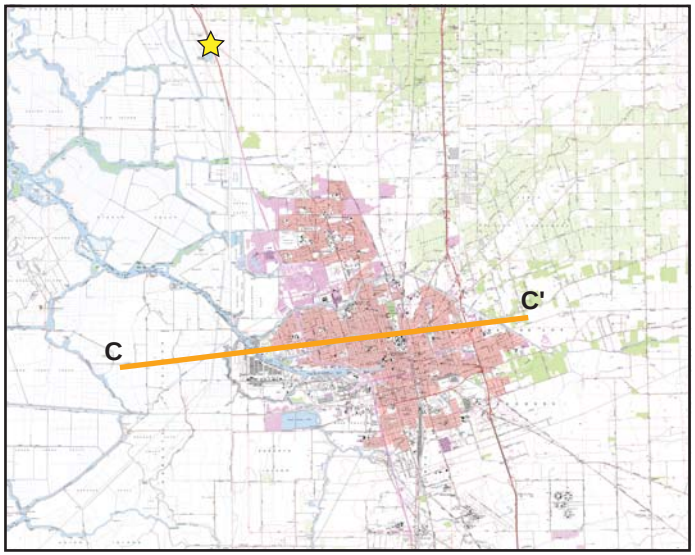
0 1,500 3,000
Feet

FIGURE D-6
GROUND WATER WELLS IN THE AREA OF REVIEW
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\LODIENERGYCENTER_371322\NCPA_LODI_UIW\MAPFILES\WELL_LOCATIONS2.MXD MHASKELL 9/16/2008 09:31:32





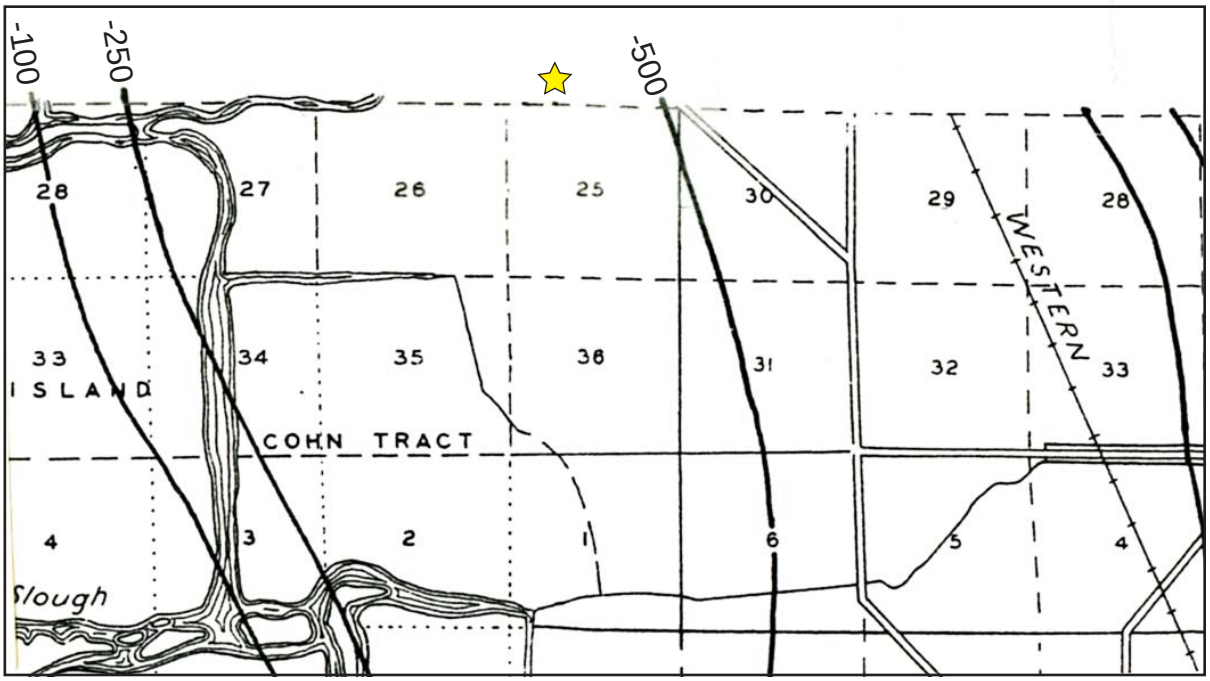
STIG-LEC Facility

Source:
After California Department of Water Resources, 1955
USGS, 1999

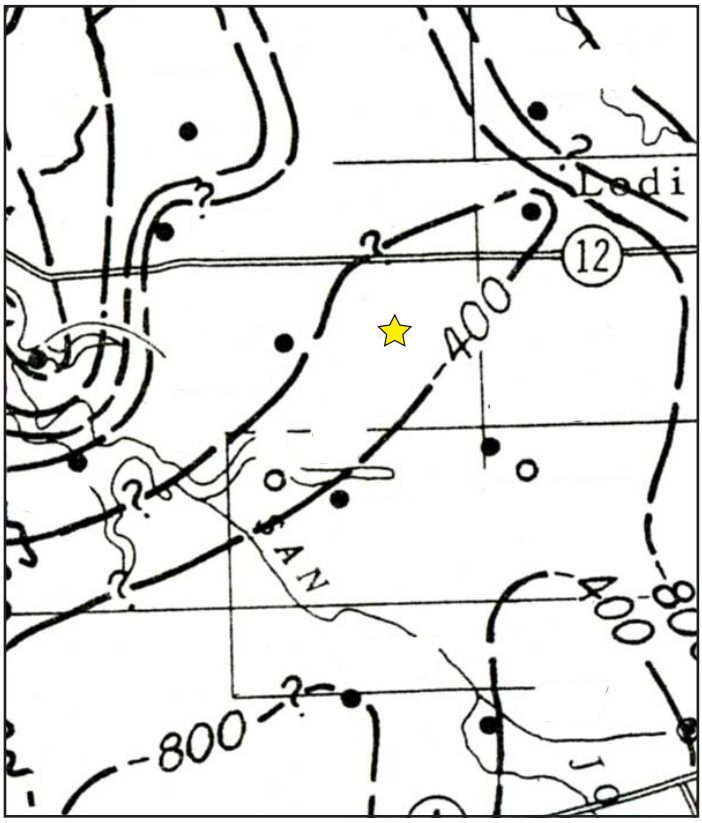
FIGURE D-7
GEOLOGIC CROSS SECTION OF THE POTABLE AQUIFERS IN THE STOCKTON AREA
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL

EY062008001SAC Figure_D-7.ai 09.10.08 afint



After DWR 1955

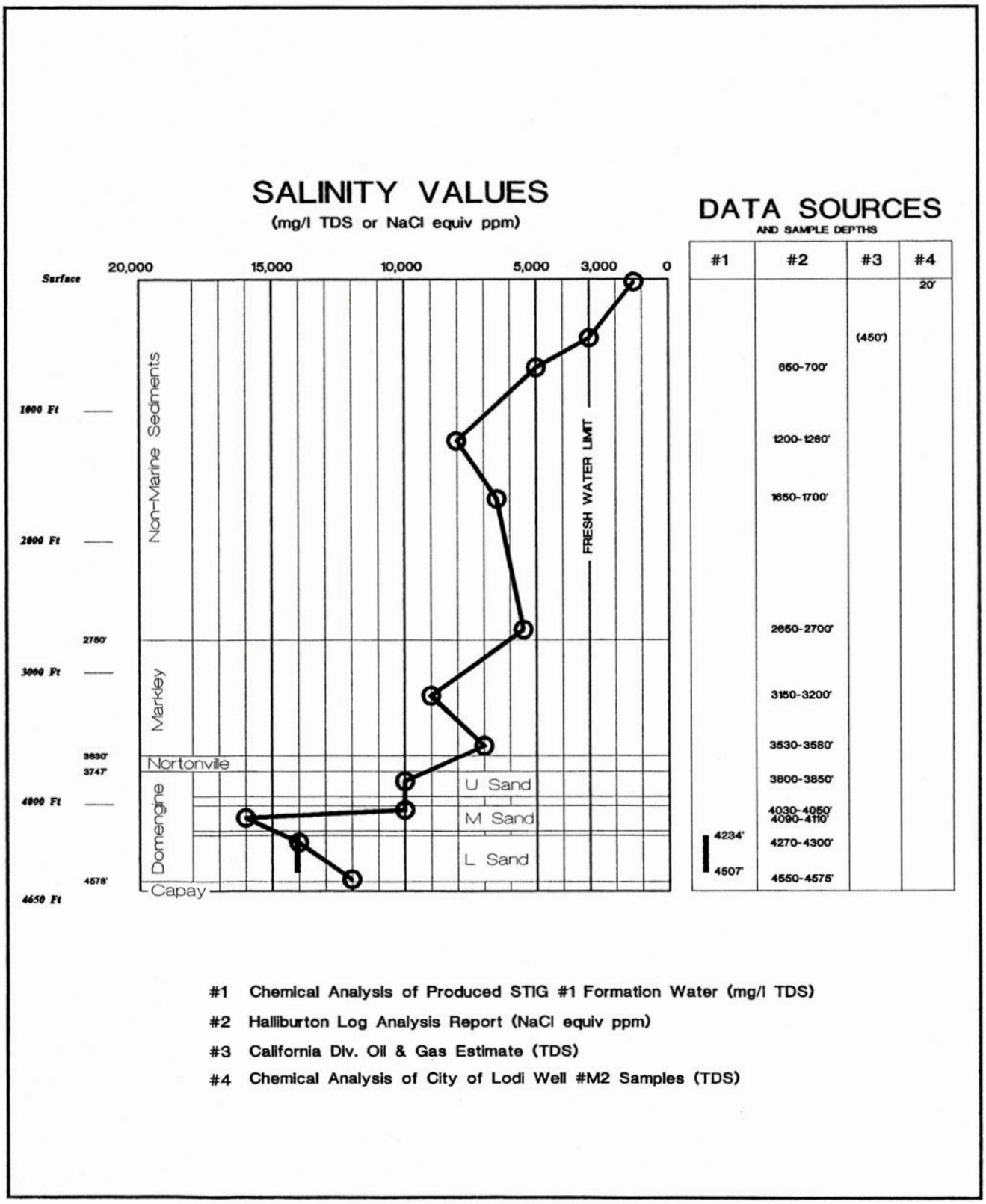


After C.F. Berkstresser, Jr., 1973

STIG-LEC Facility

Contour intervals are depth, in feet, of the base of the freshwater aquiferm identified as 3,000 mg/L TDS.

FIGURE D-8
ESTIMATED BASE OF THE FRESHWATER AQUIFER
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



Source:
Northern California Power Agency, May 1993

FIGURE D-9
SALINITY PROFILE AT THE STIG-1 LOCATION
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Attachment E
Name and Depths of USDWs (Class II)

Application Requirements

For Class II wells, submit geologic name, and depth to bottom of all underground sources of drinking water which may be affected by the injection.

Approach

Attachment E is not required for a Class I application.

Attachment F
Maps and Cross Sections of Geologic Structure of Area

Application Requirements

Submit maps and cross sections detailing the geologic structure of the local area (including the lithology of injection and confining intervals) and generalized maps and cross sections illustrating the regional geologic setting.

Approach

This section uses the information from the original maps produced for the 1993 STIG-1 UIC application and combines the geologic information originally included in Attachments D and F of the 1993 STIG-1 application. NCPA's team of consultants provided outstanding support to NCPA by developing numerous cross sections, isopach maps, and structural contour maps using existing well data. Since the time of the original permit application in 1993, no known additional deep wells have been drilled within the AOR, other than the STIG-1 well itself. Although the AOR has increased in size from 1 mile in the original permit to 2 miles in this permit, the 1993 permit had a 2-mile study area in addition to the AOR. Therefore, only supplemental information is provided to enhance the discussion of site conditions.

Regional Geology

Regional Structural Geology

The Southern Sacramento Valley and Sacramento Delta Areas are part of the Great Valley Geomorphic Province, which is a nearly flat alluvial plain that extends from the Klamath Mountains south to the Tehachapi Mountains. To the east are the Sierra Nevada Mountains and to the west are the Coast Ranges (Figure F-1).

The Sierra Nevada, Great Valley, and Coast Ranges geologically represent an arc-trench system that resulted from the convergence and subduction of the Pacific oceanic crust underneath the North American Plate during Mesozoic and early Quaternary time. The Great Valley, representing a fore-arc basin, has been filled by a sequence of sediments eroded primarily from the Sierra Nevada arc. The area near Lodi is on the eastern side of this north-south elongated trough, with the deepest part of the basin being about 20 miles further west.

The three principal geologic structures in this general region are the Thornton arch (to the north of the site), the Stockton Fault (to the south), and the Midland Fault Zone (to the

west). The Thornton arch is an east-west to northwest-southeast trending anticlinal feature located almost 10 miles north of the site, representing the structural crest located up-dip from STIG #1. The Stockton Fault, found 12 miles south of the STIG-LEC facility, is an Eocene cross-valley feature that separates the relatively down-dropped Delta area from the northern part of the San Joaquin Valley. The Midland Fault Zone, located 14 miles west of the STIG-LEC facility, represents a zone of west-dipping normal faults that ceased active movement more than 30 million years ago in the area.

Regional Stratigraphy

The eastern shelf of the Southern Sacramento Valley has a basement complex composed of Sierran granitics that intrude Jurassic metasediments and metavolcanic rock units. Immediately overlying the basement rocks of the Lodi area is a 5,500-foot-thick series of Upper Cretaceous marine sedimentary units that are the accumulated detritus derived from eastern Sierran upland sources. This sequence began with relatively deep-water Guinda and Forbes turbidities; continued with a progressively shallowing (regressive) marine – deltaic-fluvial environments; and ultimately ended with uplift, subaerial exposure, and limited erosion.

Unconformably overlying the Cretaceous section is a series of five Eocene formations that have a total thickness of about 2,500 feet in this region. The Meganos and Capay shale units represent two distinct episodes of transgressive gorge and deltaic fill, followed upward by deposition of the mature, well-sorted marine Domengine sands, a deeper environment unit of Nortonville Shale, and a shallowing marine sequence of Markley thin sand-siltstone-shale interbeds. Non-marine continental deposits that range in age from Oligocene to Recent represent the most near-surface 2,750 feet of stratigraphic section found in the region. This stratigraphy is summarized in Figure F-2.

Regional Tectonic History

The tectonic history of the eastern shelf of the Southern Sacramento Valley is fundamentally related to its initial setting as a fore-arc basin. The deposition of the thick sequence of Cretaceous marine sediments was contemporaneous with magmatism and uplift in the Sierra Nevada, and with deposition and deformation of the trench-filling Franciscan Complex located to the west where the Coast Ranges now exist. By the end of the Cretaceous, this eastern shelf area was tilted to the south and west, uplift to the west had formed a broad ridge essentially damming the basin from the ocean, and mild regional deformation had initiated formation of the faults and folds in the area.

Intermittent periods of uplift and subsidence affected the depositional basin throughout the Early Tertiary, and by the end of Oligocene time, the convergent arch-trench system was replaced by the San Andreas transform fault system that operates at present. This system of near-vertical, right lateral displacement faults passes through the San Francisco Bay Area 50 miles west of the Lodi area, as it extends from the Imperial Valley of Southern California to Cape Mendocino.

Following the development of that San Andreas system, the only significant geologic activity to occur within the eastern shelf region of the Southern Sacramento Valley has been the gradual filling of the basin by detritus derived from the western slope of the Sierra.

Geologic Cross Sections

Figure F-3 shows the local surficial geology for the area surrounding the STIG-LEC facility. This figure is a combination of the Sacramento and the San Francisco-San Jose Quadrangle Geologic Maps of the State of California. A regional cross section showing some of the local folds and faults is shown in Figure F-4.

Two perpendicular geologic cross sections were developed using geophysical logs from exploratory gas wells to show the local subsurface geology in the STIG-LEC facility area. Figure F-5 shows the location of the wells used to develop the cross sections. The cross sections are shown in Figures F-6 and F-7. The cross sections intersect the STIG-1 well and extend to a depth of 6,000 feet, which is well below the 4,650-foot total depth of STIG-1, the proposed depth of LEC-1, and the USDWs.

The cross sections show the shallow dip of approximately 2 degrees to the southwest. Most units also thicken basinward, toward the west or southwest, with the exception of the Meganos Gorge Fill unit, which thins away from the STIG-1 well toward the northwest and southeast.

History of Local Hydrocarbon Production

The creation of structural traps from the region's tectonic history and sedimentary traps from historic deposition created opportunities for hydrocarbon production. Numerous exploratory wells have been drilled in the area since the 1950s to evaluate this potential. Although numerous small hydrocarbon fields—primarily gas fields—have been identified in the region (Figure F-8), seven of the eight deep wells drilled for hydrocarbon exploration within the 2-mile AOR were destroyed within days or weeks of completing the drilling and/or testing programs for each well (see Table C-1).

The one active gas well within the AOR (Piacentine #1-27) is still producing gas, although not at the levels observed during its initial operation.

Injection Zone

The lower sand member of the Domengine Formation was originally selected as the target injection unit for the STIG-1 well because:

- Salinity is greater than 10,000 mg/L TDS.
- It had been demonstrated to have adequate injectivity.
- It is confined by a regionally extensive shale unit.
- Injection was not expected to have (nor has it shown to have) any influence on existing water wells or local groundwater resources.

Additional discussion of the Domengine Formation is included in Attachment I.

Physical Extent

The Domengine Formation isopach map (Figure F-9), developed for the original permit by examination and correlation of DOGGR well records and geophysical logs (Table F-1), is based on 22 thickness values. The thickness of the injection unit is 831 feet and is not less than 780 feet thick within the AOR. The Domengine thins toward both the Lodi Airport to the east and the East Islands Gas Fields to the northwest.

The Domengine Formation structure contour map (Figure F-10) is based on 23 wells that penetrated the top of the formation. The formation dips about 2 degrees uniformly to the southwest. A structural nose 2 to 3 miles to the east of the facility occurs below and, coincidentally, is generally aligned with the railroad line that runs northwest-southeast. A second less prominent structural nose occurs 1 to 2 miles west of the facility, and is oriented to the northeast-southwest. Gas fields appear to be associated with these structural features. The structure contour map does not indicate any closed structural features in the area.

Description

The Domengine Formation consists of two to three sand intervals separated by siltstone or shale. It is a coarse-grained, gray to brown marine quartz sandstone with feldspar and occasional glauconite. It is exposed to the west in the Mount Diablo area.

Physical Properties

The hydraulic conductivity and permeability of the injection zone within the Domengine Formation has been measured several times during routine testing since the well was installed in 1994. The averages of these measurements was used to calculate the AOR and are summarized in Tables A-2 and A-3. The hydraulic conductivity of the injection zone is estimated to be 0.591 feet/day and the permeability to be 142 millidarcys.

Confining Zones

The upper confining zone is the Nortonville Formation. The lower confining zone is the Capay Formation. They are shown in the two cross sections (Figures F-2 and F-3).

Nortonville Shale

The Nortonville shale is a dark gray marine shale and siltstone that is the upper confining unit for the injection zone. In some areas, minor sandstone, coal, and glauconitic sandstone can also occur within it. In parts of the state, it produces gas.

The Nortonville shale isopach map (Figure F-11) has thickness estimates from 24 local wells. The thickness of the Nortonville Shale ranges from 100 to more than 200 feet within the area contoured. This includes a thickness of 117 feet at the STIG-1 well. Overall, the unit thickens to the southeast.

Capay Formation

The Capay Formation is the lower confining shale unit for the injection zone. It is a marine shale to silty shale with occasional sand stringers. The Capay Formation is being considered and studied for a possible carbon-sequestration project within the sand stringers in the

former Rio Vista Gas Field, located 12 to 15 miles to the northwest of the STIG-LEC facility (Trautz et al, 2007).

The STIG-1 well boring intentionally did not penetrate the bottom of the unit. Based on the isopach map (Figure F-12), the estimated thickness of the Capay Formation is 150 feet.

Seismic Activity

The general region that surrounds the STIG #1 proposed injection site is characterized by a very low level of seismic activity. No active faults are mapped within 25 miles of this site. As shown in Figure F-13, the most recent earthquake nearby occurred on the Greenville Fault, located approximately 30 miles west of STIG #1 (Jennings and Saucedo, 1999). The Antioch Fault, another potentially active fault, is located near the Greenville Fault. No other known active faults are located within 50 miles of the site.

The potential shaking hazard resulting from seismic activity near the site is estimated from information available on the California Geological Survey Web site (http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html). The STIG-LEC facility is located in an area that can expect between 10 to 20 percent peak ground acceleration. This is a relatively low seismic shaking potential.

In addition to the review of active local and regional faults, existing information on subsurface faulting of the injection formation and the upper and lower confining units was assessed using DOGGR maps and cross-sections of existing oil and gas fields (DOGGR 1982). Based on cross sections constructed through the Lodi Airport and Harte gas fields (3 and 4-1/2 miles southeast from the STIG-LEC site, respectively), local faulting in both areas is assumed (Figure F-14). Based on the productive history of these sites, the faults created structural traps for local hydrocarbons and, therefore, are likely not conduits of gas or fluid migration. Faults are not known to be present within the AOR, based on local geophysical log information used to develop the Domengine Formation structural map for the 1993 permit (Figure F-10).

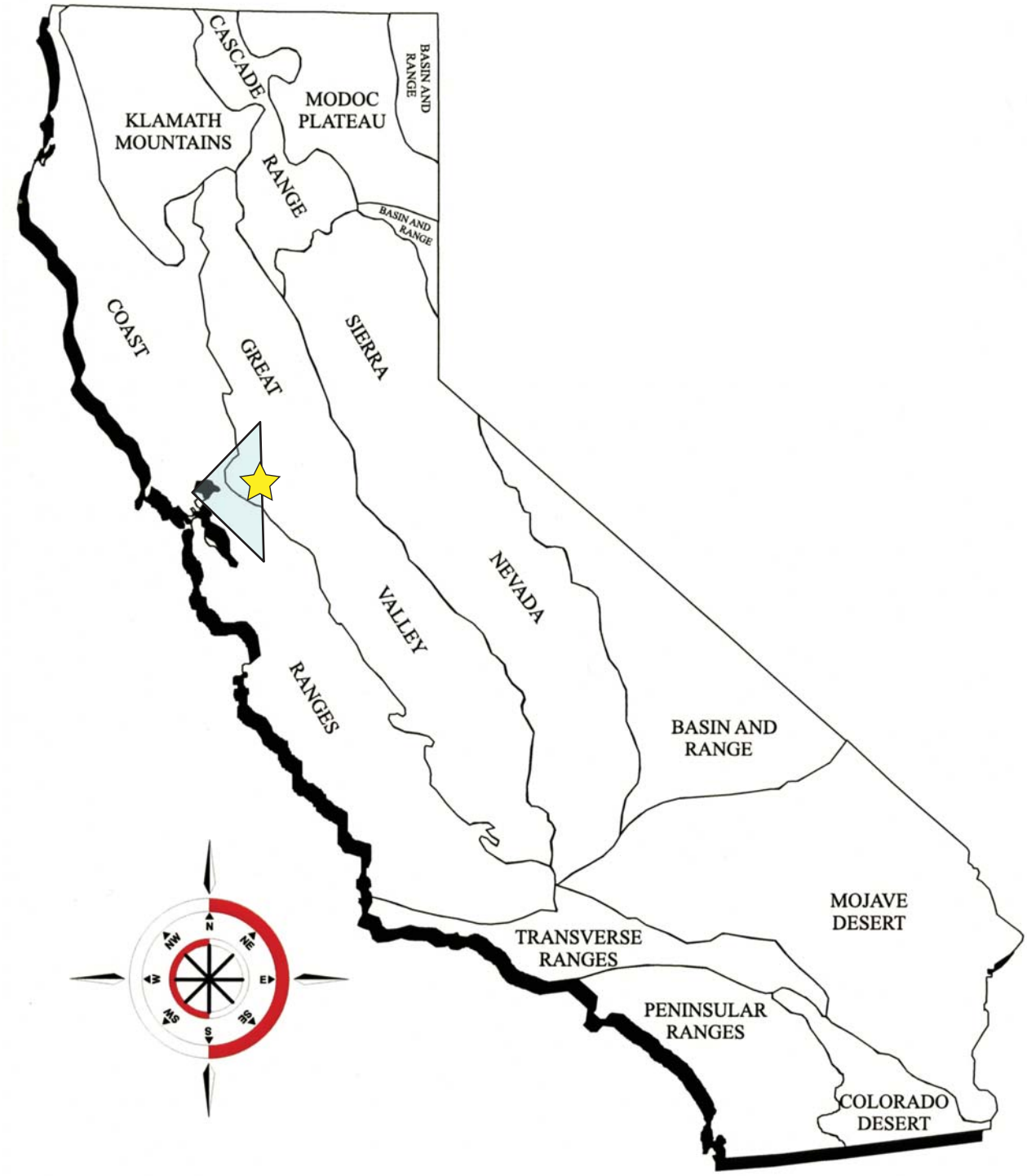
TABLE F-1
Stratigraphic Information from Deep Well Geophysical Logs

	NORTONVILLE FORMATION		DOMENGINE FORMATION		CAPAY SHALE		MEGANOS GORGE
WELL NAME AND NUMBER	**Elevation**	**Thickness**	**Elevation**	**Thickness**	**Elevation**	**Thickness**	**Elevation**
STIG-1	-3,610	117	-3,727	831	-4,558	not determined	not reached
City of Lodi #1	-3,573	117	-3,690	821	-4,511	165	-4,676
Federal Imeson #1	-3,666	124	-3,790	852	-4,642	134	-4,776
Red House Fee #65-24	-3,533	126	-3,659	783	-4,442	149	-4,591
Rio Blanco #1	-3,762	126	-3,888	970	-4,858	125	-4,983
Piacentine #1-27	-3,693	93	-3,786	777	-4,563	103	-4,666
Perrin #1	-3,484	159	-3,643	772	-4,415	126	-4,541
CPC Hatch #31-1	-3,688	205	-3,893	803	-4,696	146	-4,842
Buttes Rio Blanco #15-77X	-3,506	82	-3,588	796	-4,384	119	-4,503
Buttes #15-37X	-3,544	67	-3,611	823	-4,434	134	-4,568
Buttes Coldani #15-44X	-3,436	106	-3,542	794	-4,336	114	-4,450
Coldani #CH-1	-3,462	57	-3,519	779	-4,298	112	-4,410
Ratto #14-1	-3,481	86	-3,567	827	-4,394	121	-4,515

From Northern California Power Agency, May 1993

Depths in mean sea level, thicknesses in feet.

Figures

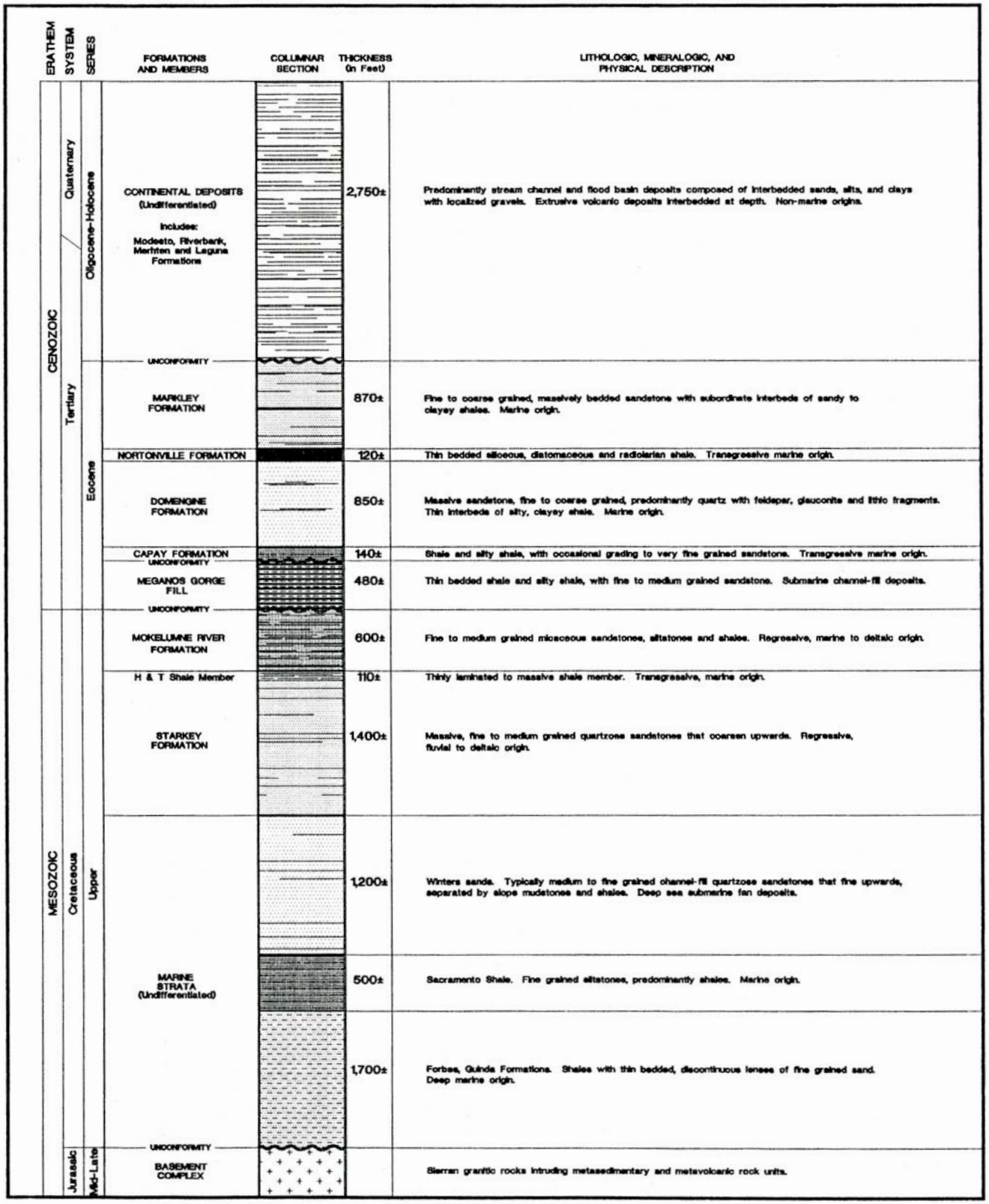


STIG-LEC Facility

General Area referred to as 'The Delta'

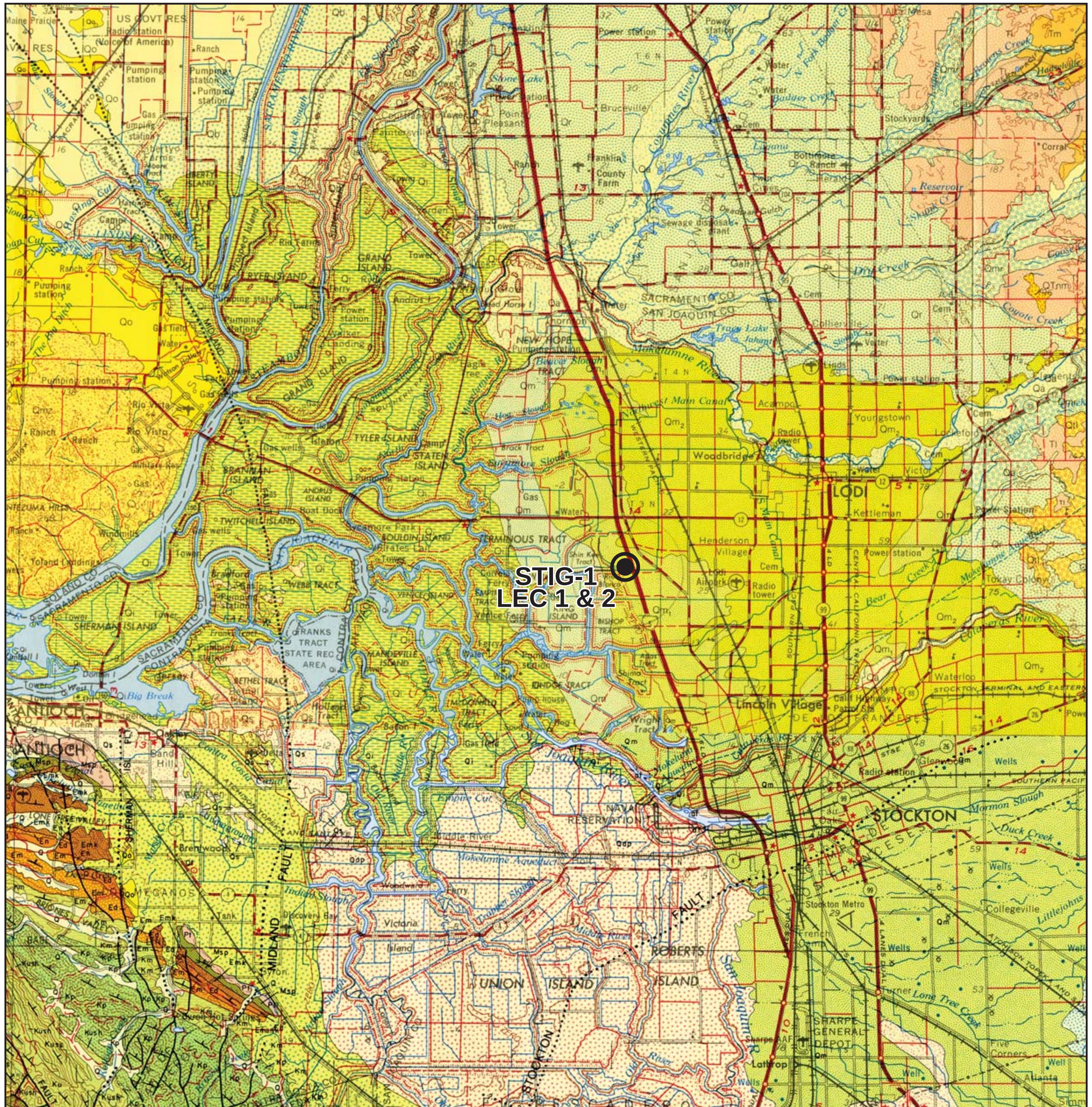
Source:
California Geological Survey 2002

FIGURE F-1
CALIFORNIA GEOMORPHIC PROVINCES
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



Source:
Northern California Power Agency, May 1993

FIGURE F-2
STRATIGRAPHIC COLUMN FOR THE STIG-1 AREA
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



SEDIMENTARY AND
METASEDIMENTARY ROCKS

CENOZOIC

QUATERNARY

- Q — Alluvium
- ? — Mine and dredge tailings
- Qa — Levee and channel deposits
- Qb — Basin deposits *(Alluvium)*
- Qi — Intertidal deposits *(Peaty mud)*
- Qs — Dune sand
- Ql — Lake deposits
- Qo — Older alluvium
- Qg — Glacial deposits
- Qm — Modesto Formation *(Alluvium)* — Qm_1 / Qm_2 Upper and lower members
- Qr — Riverbank Formation *(Alluvium)*
- Qmr — Modesto-Riverbank Formations *(Arkosic alluvium)*
- Qmz — Montezuma Formation *(Poorly consolidated, clayey sand)*
- Qtl — Turlock Lake Formation *(Sand, silt, and gravel)*
- Qrb — Red Bluff Formation *(Gravel in reddish, silty or sandy matrix)*
- QTnm — North Merced Gravel *(Thin pediment veneer)*

TERTIARY

- Tt — Tehama Formation *(Sand, silt, and volcaniclastic rocks)*
- Tl — Laguna Formation *(Consolidated alluvial deposits)*
- Tsp — San Pablo Group *(Marine sandstone and shale)*
- Tm — Mehrten Formation *(Andesitic conglomerate, sandstone, and breccia)*
- Tvs — Valley Springs Formation *(Rhyolitic tuff and sedimentary rocks)*
- Tma — Markley Sandstone *(Marine)*
- Tn — Nortonville Shale *(Marine)*
- Td — Domengine Sandstone *(Marine)*
- Tc — Capay Formation *(Marine sandstone)*
- Tg — "Auriferous" Gravels
- Ti — Ione Formation *(Quartzose sandstone and kaolinitic clay)*
- Tmz — Martinez Formation *(Marine quartzose sandstone)*

Sources:
Wanger et al 1990 and Wagner et al 1991

FIGURE F-3
GEOLOGIC MAP OF THE LODI AREA
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

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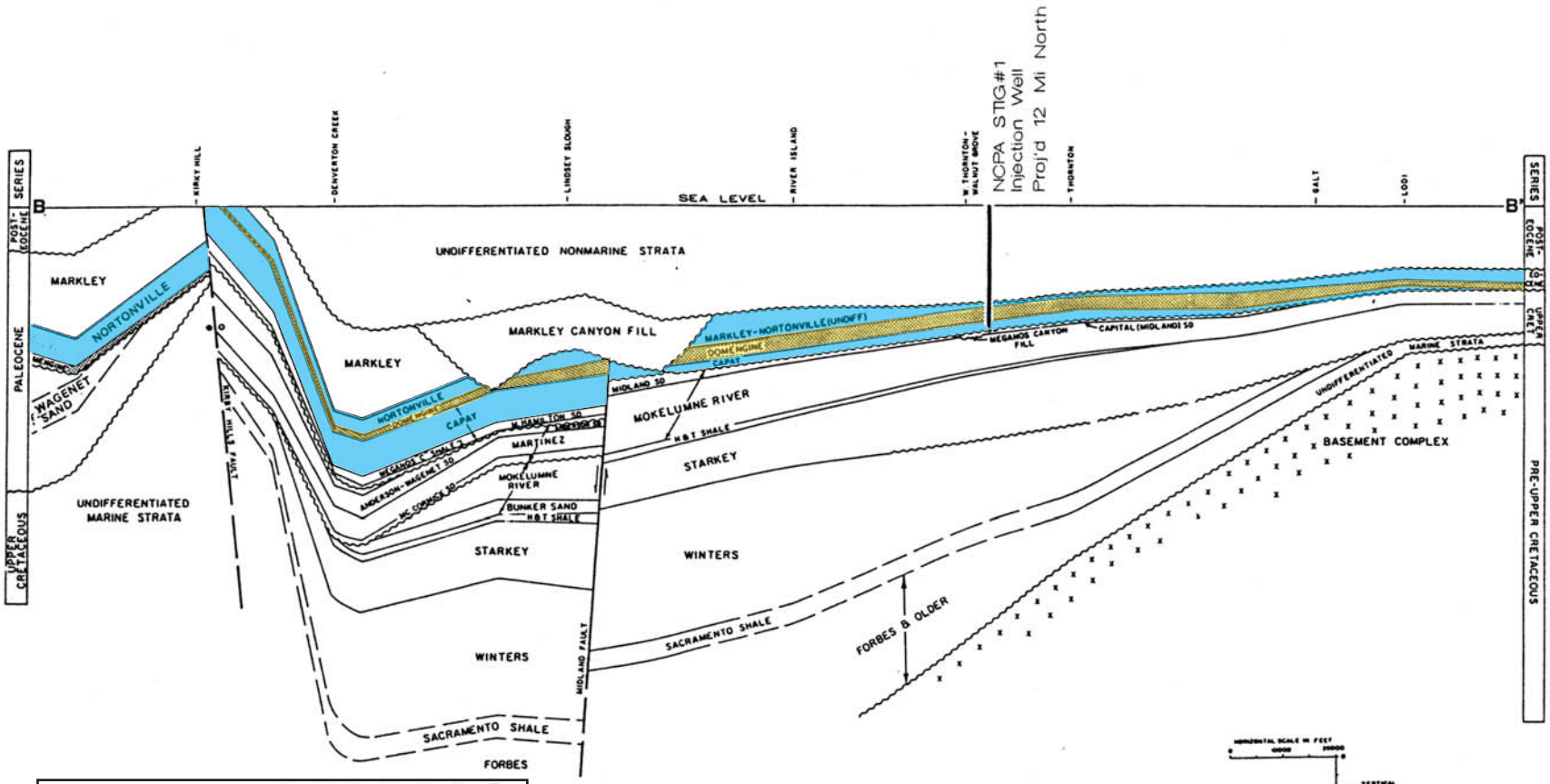

Source:
Northern California Power Agency, May 1993

FIGURE F-4
REGIONAL CROSS SECTION
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL

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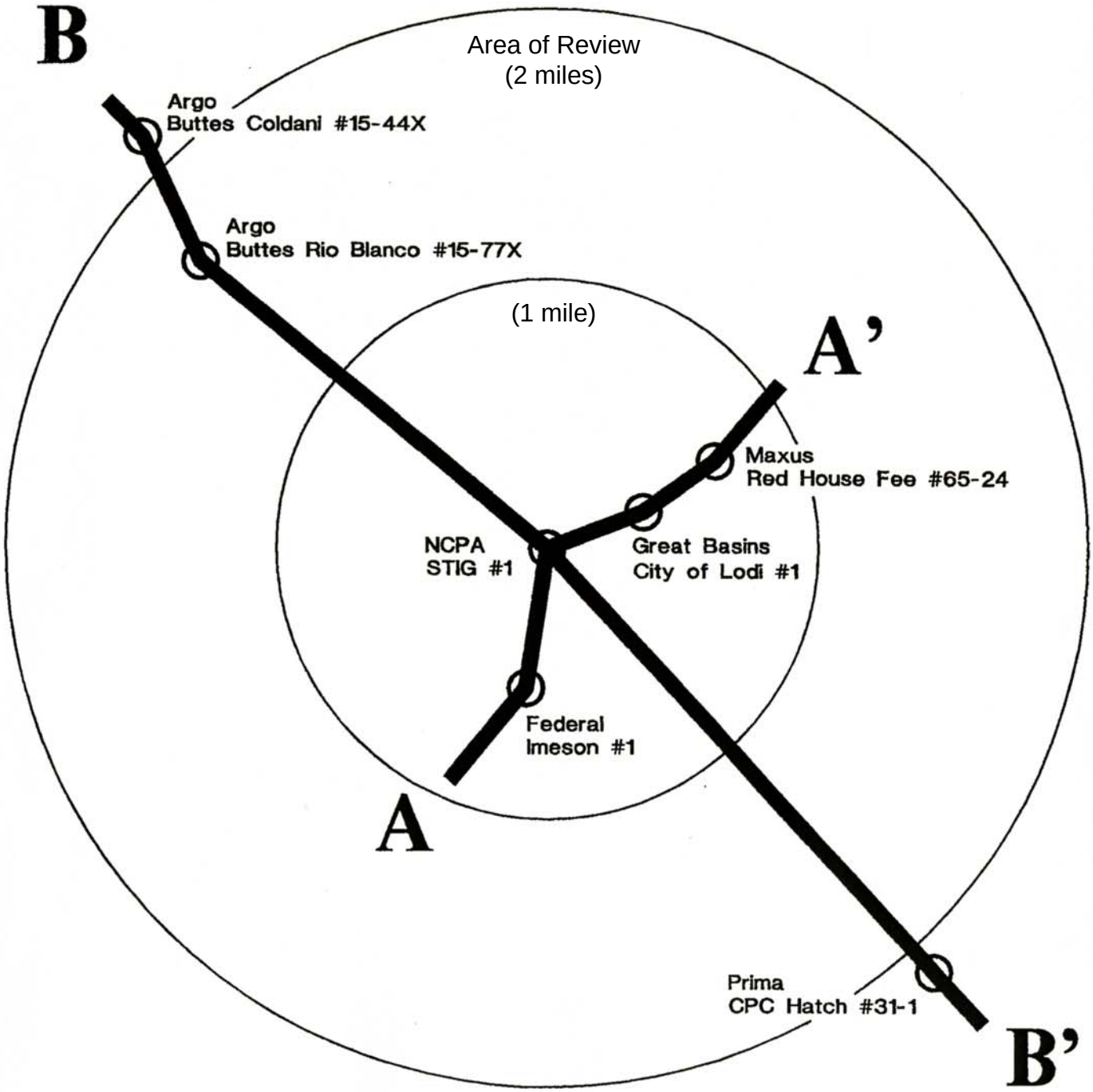
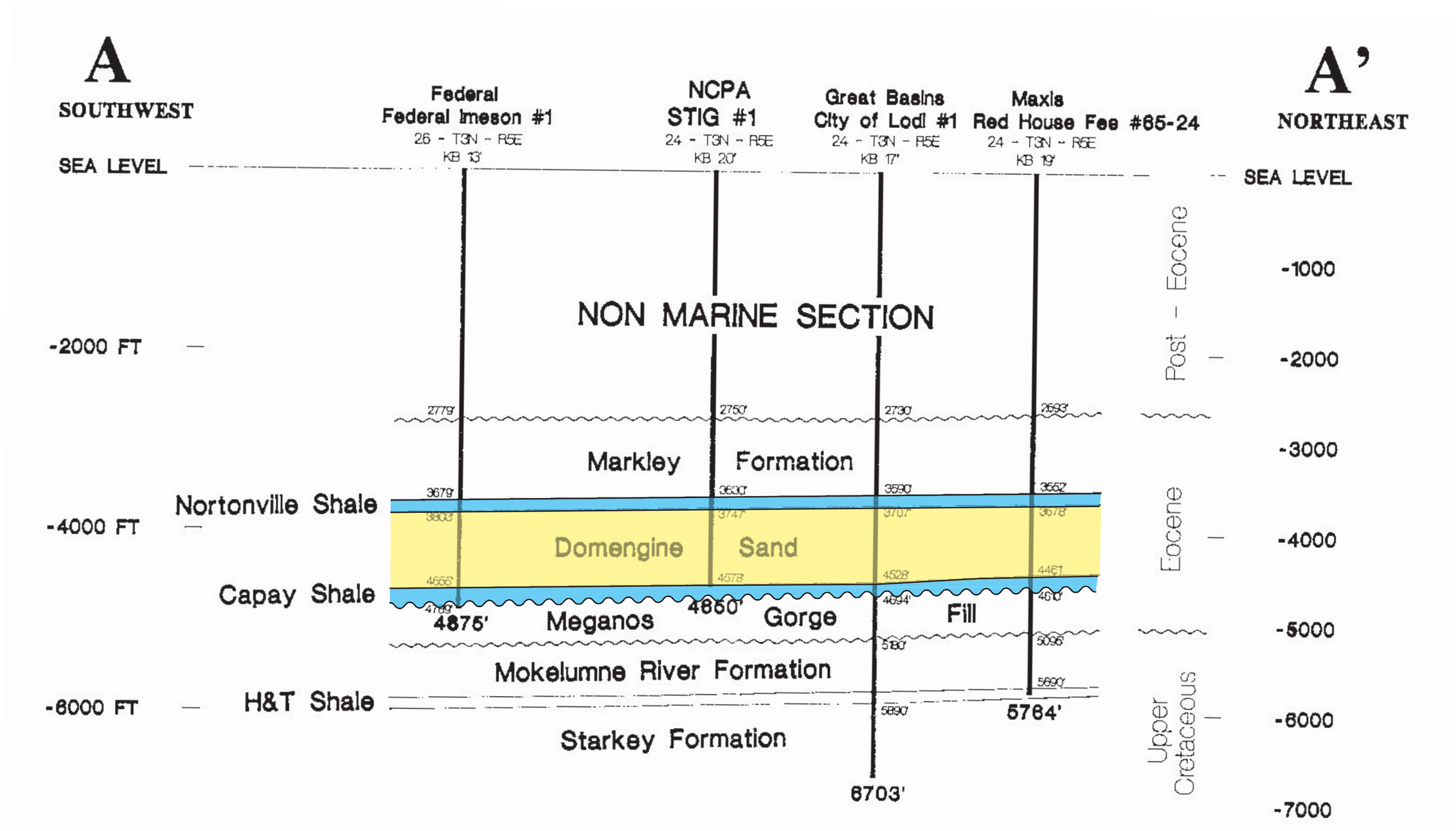


FIGURE F-5
LOCATION OF CROSS-SECTIONS AND AREA OF REVIEW

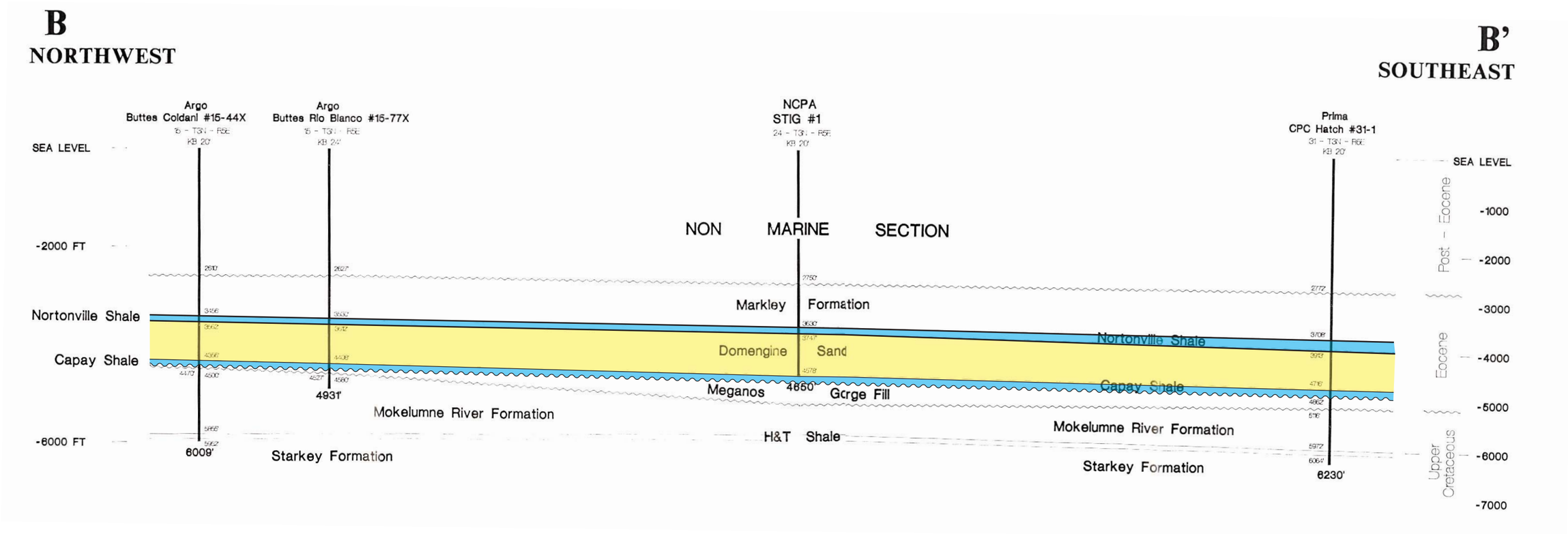
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Source:
Northern California Power Agency, May 1993



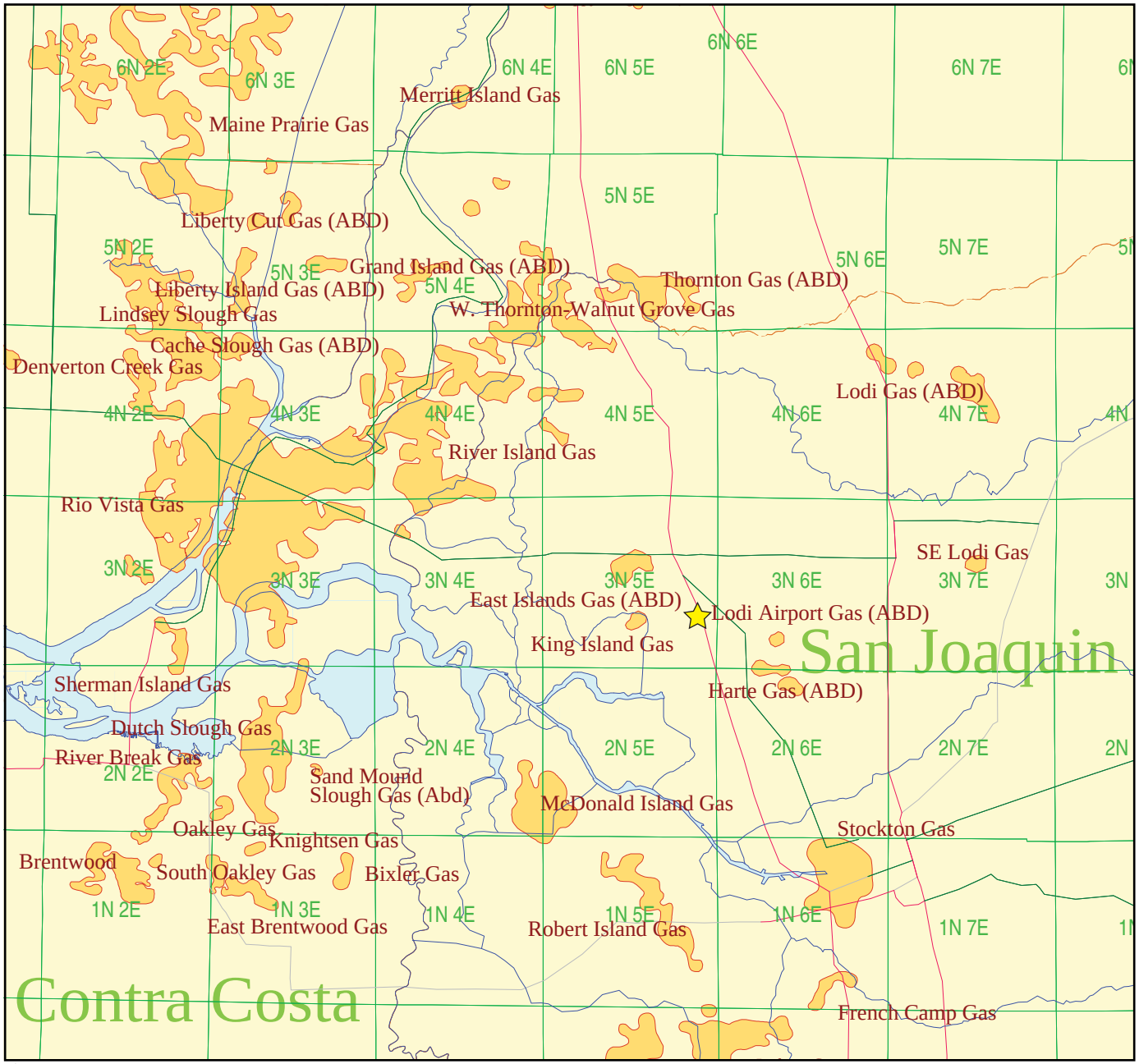
The cross-section was developed in 1993 (NCPA) based on formation contacts determined from geophysical logs. These formation contacts are summarized in Table F-1. Some geophysical logs are included in Appendix 4. The remaining logs are accessible at the DOGGR website (http://owr.conservation.ca.gov/WellSearch/WellSearch.aspx)

FIGURE F-6
STRUCTURAL CROSS SECTION SOUTHWEST TO NORTHEAST
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



The cross-section was developed in 1993 (NCPA) based on formation contacts determined from geophysical logs. These formation contacts are summarized in Table F-1. Some geophysical logs are included in Appendix 4. The remaining logs are accessible at the DOGGR website (http://owr.conservation.ca.gov/WellSearch/WellSearch.aspx)

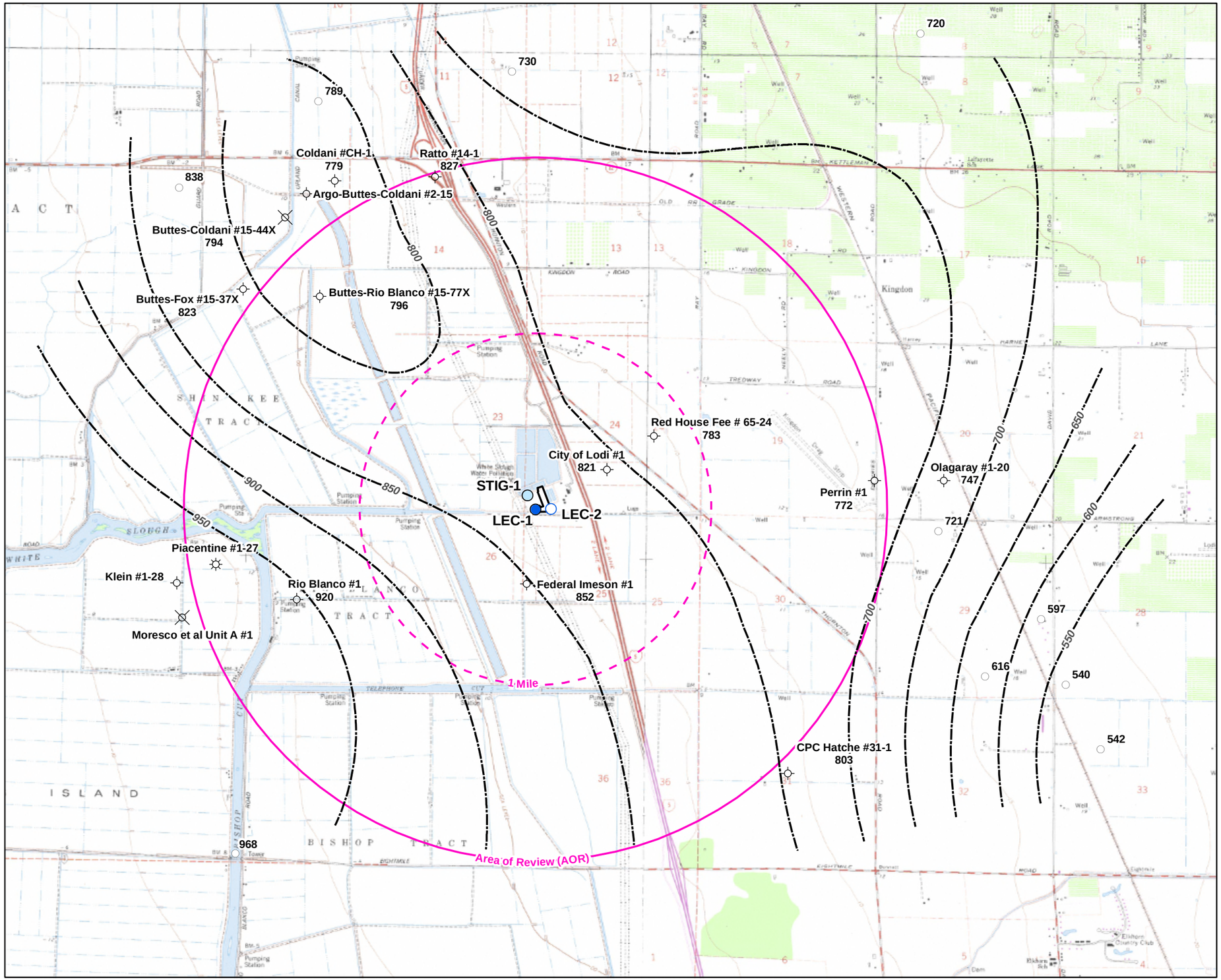
FIGURE F-7
STRUCTURAL CROSS SECTION NORTHWEST TO SOUTHEAST
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



STIG-LEC Facility

Source:
California Department of Conservation, June 1999

FIGURE F-8
LOCATION OF GAS FIELDS
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION



LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- Other Well Outside Study Area
- Domengine Thickness (ft)
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: Class 1 Underground Injection Lodi Control Well Permit Application for October, 1993.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE F-9
DOMENGINE FORMATION ISOPACH MAP
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

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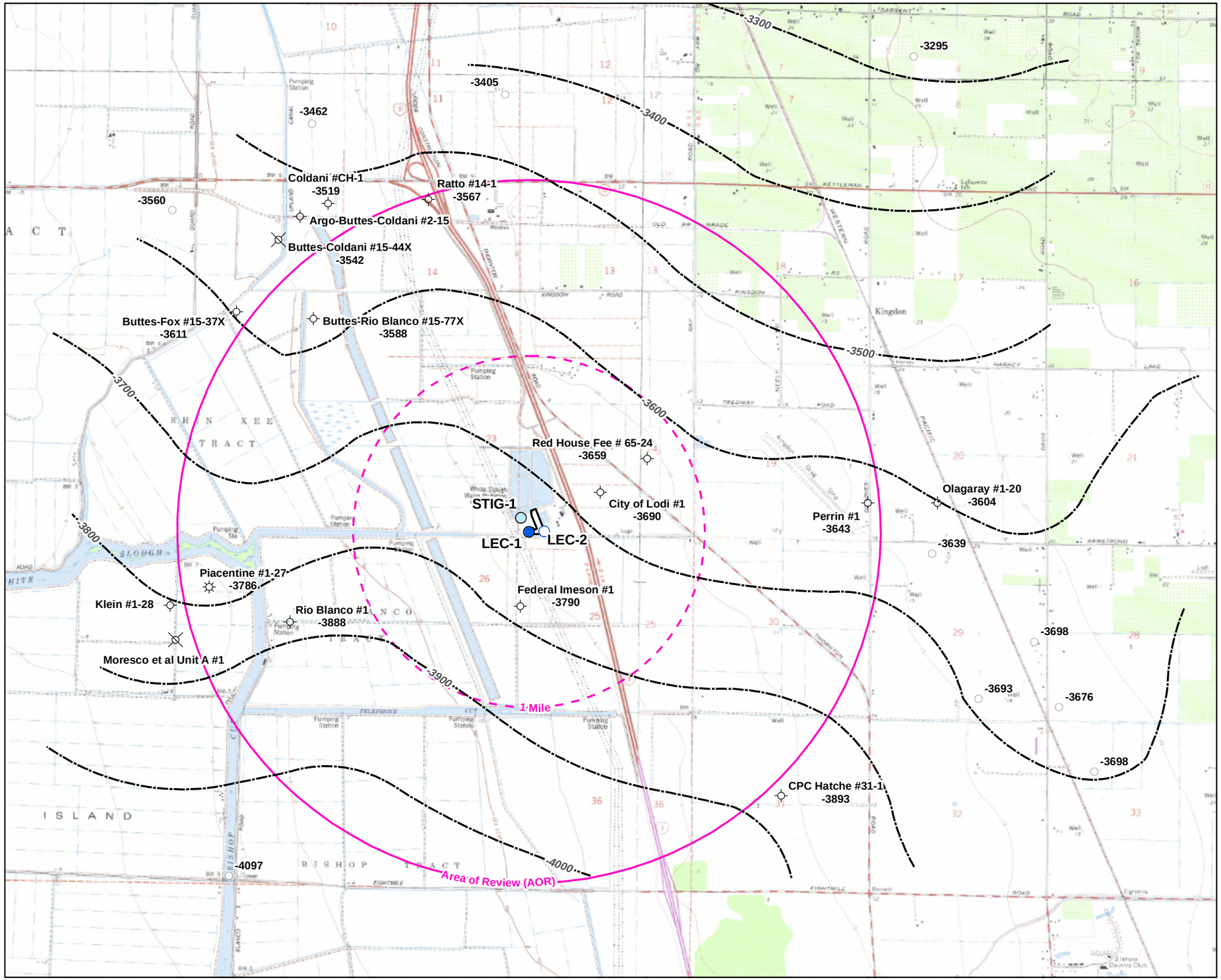

LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- Other Well Outside Study Area
- Structure Contour
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: Class 1 Underground Injection Lodi Control Well Permit Application for October, 1993.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE F-10
DOMENGINE FORMATION STRUCTURE CONTOUR MAP
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

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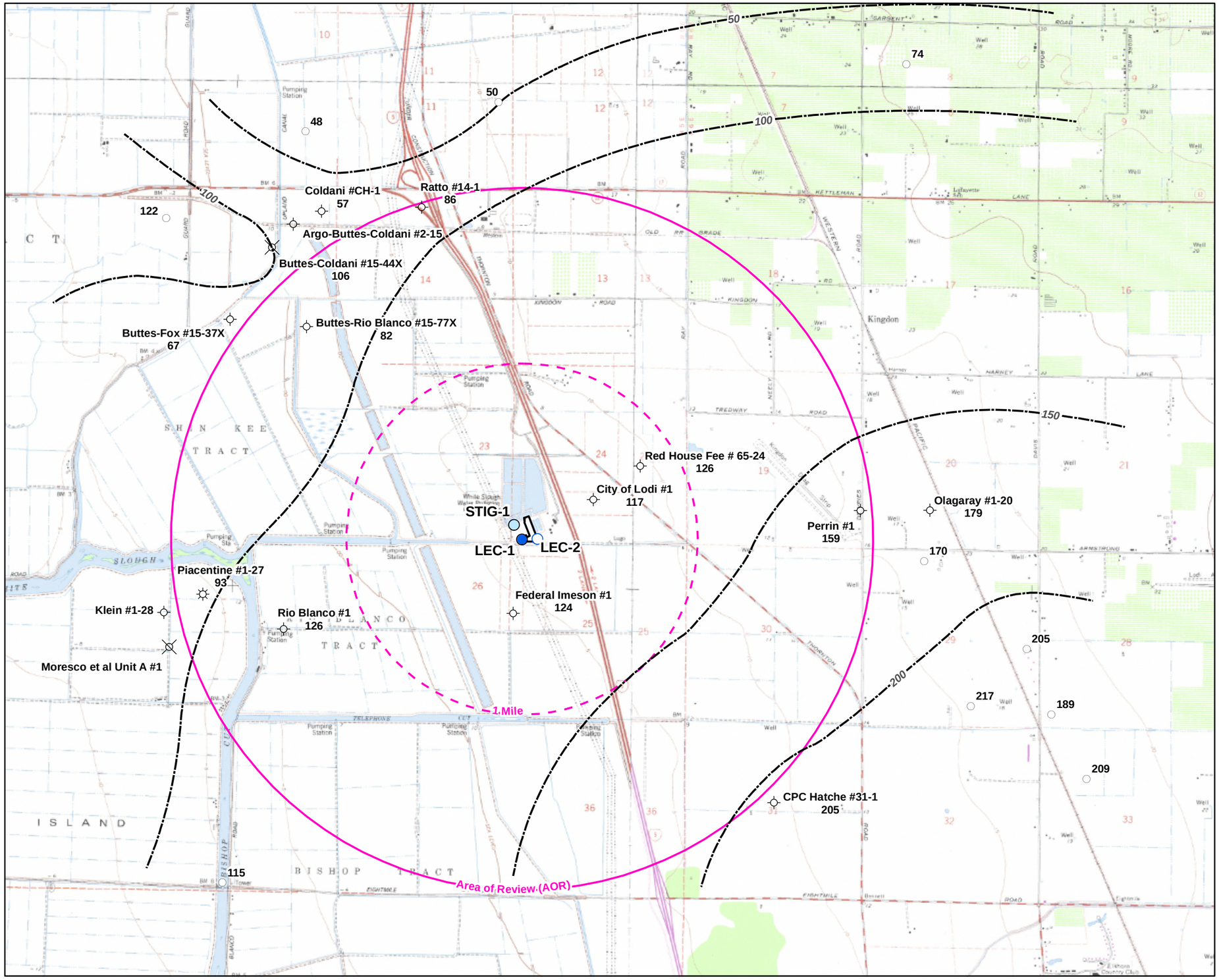

LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- Other Well Outside Study Area
- Nortonville Thickness (ft)
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: Class 1 Underground Injection Lodi Control Well Permit Application for October, 1993.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE F-11
NORTONVILLE SHALE ISOPACH MAP
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

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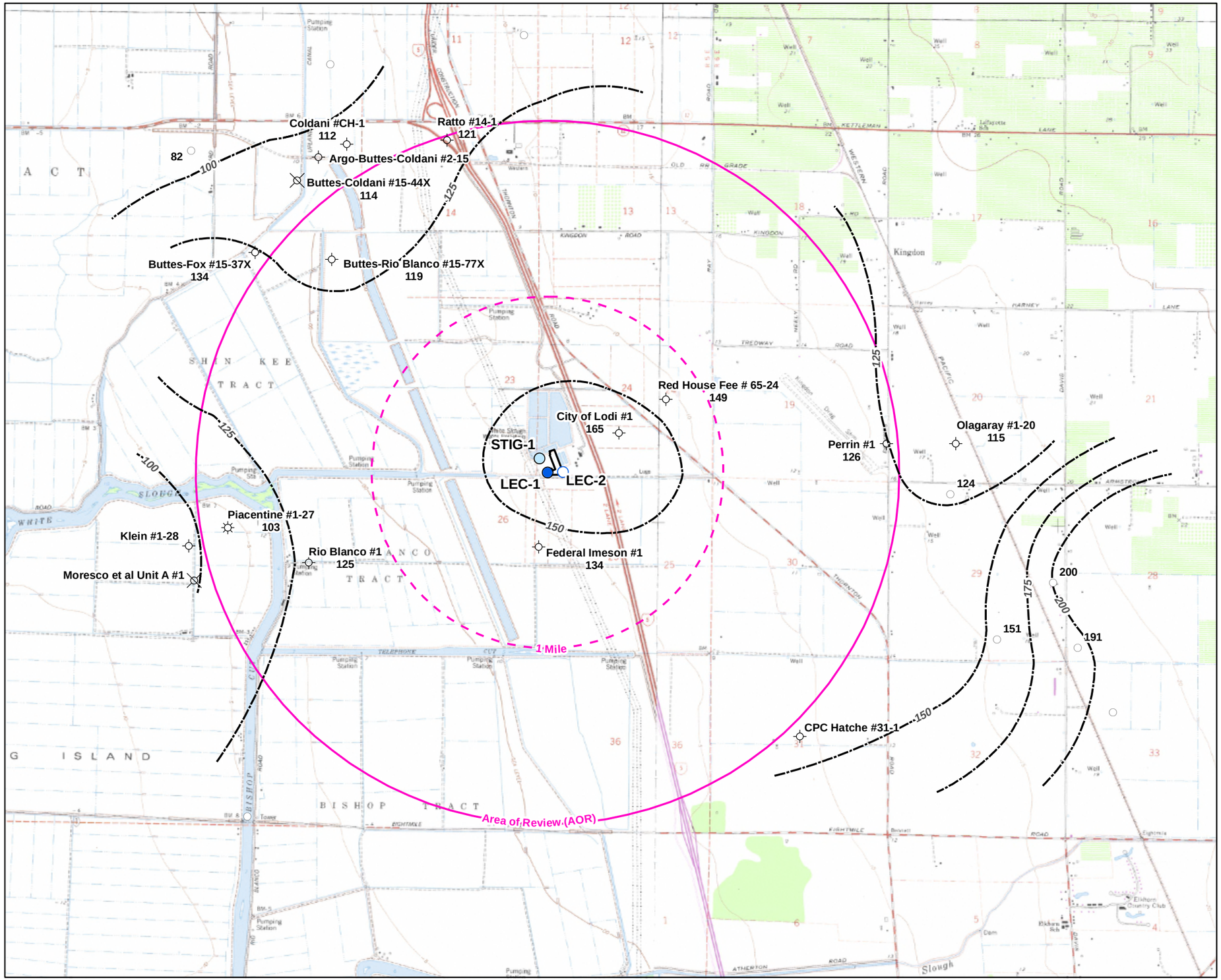

LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- Other Well Outside Study Area
- Capay Thickness (In Feet)
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: Class 1 Underground Injection Lodi Control Well Permit Application for October, 1993.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE F-12
CAPAY SHALE ISOPACH MAP
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

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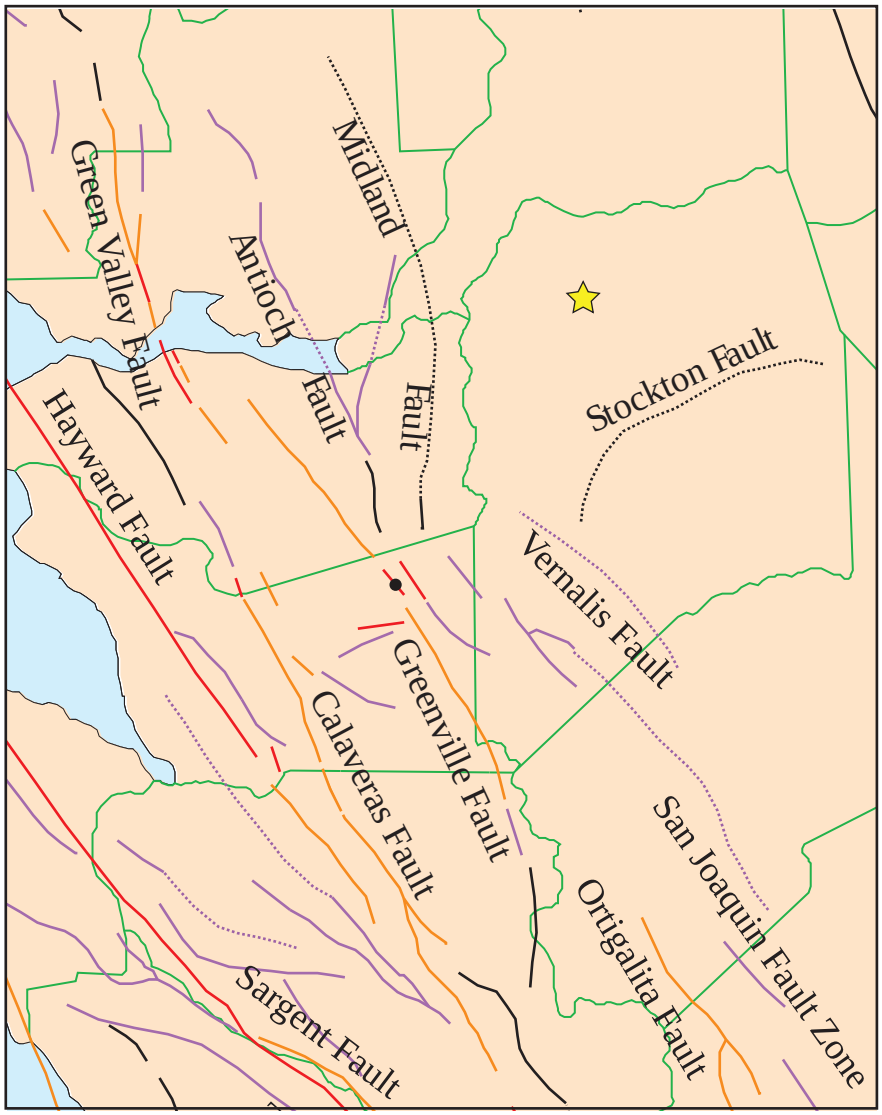


EXPLANATION

Geologic Time		Fault Symbol	Years Before Present	Recency of Movement	Description
QUATERNARY	Historic				Historic ground ruptures, including creep.
			200		
	Holocene			? ?	Holocene displacement
			10,000		
	Pleistocene			?	Pleistocene faults. Many faults in Sierra Nevada shown as pre-Quaternary may be late Cenozoic.
			1,600,000		
PRE-QUATERNARY			4.5 billion (Age of earth)		Faults without recognized Quaternary displacement. Not necessarily without future activity potential.

● 1980 earthquake on the Greenville Fault Magnitude 5.8

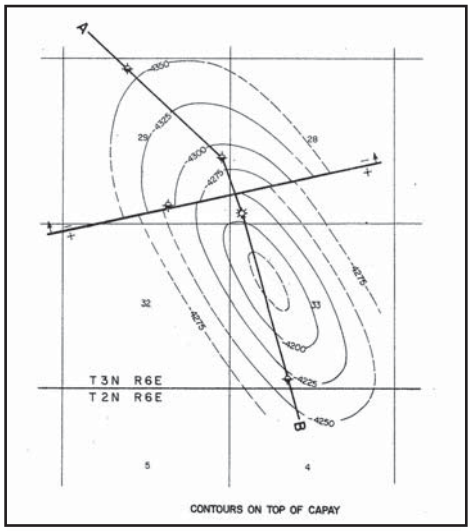
Faults dotted on land where concealed

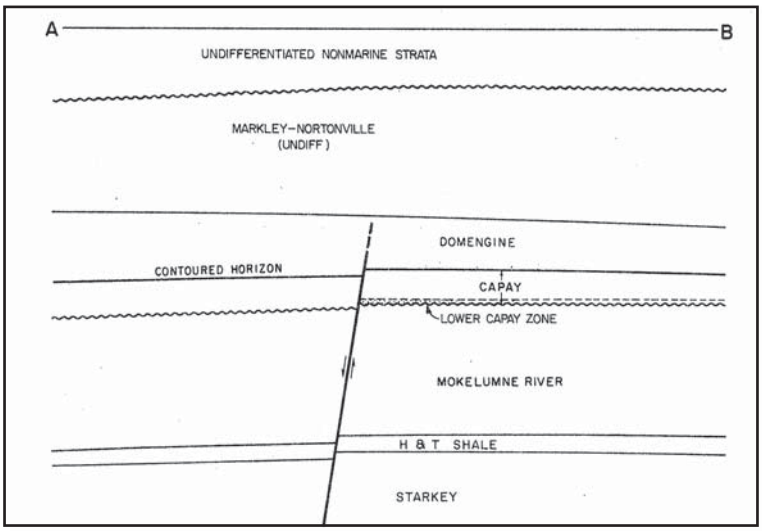
STIG-LEC Facility

Source:
Compiled by Charles W. Jennings and George J. Saucedo, 1999
(Revised 2002, Tousson Toppozada and David Branum)

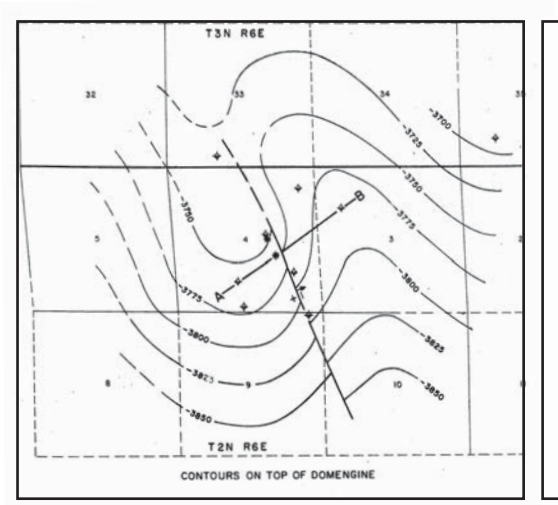
FIGURE F-13
REGIONAL FAULT MAP
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

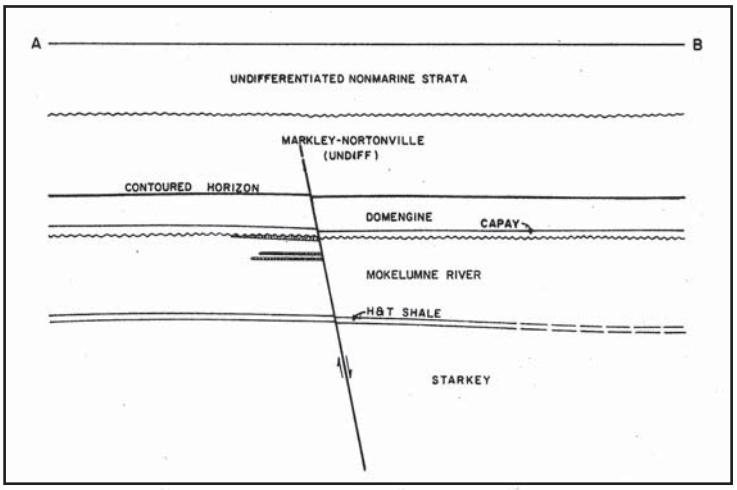
Lodi Gas Field

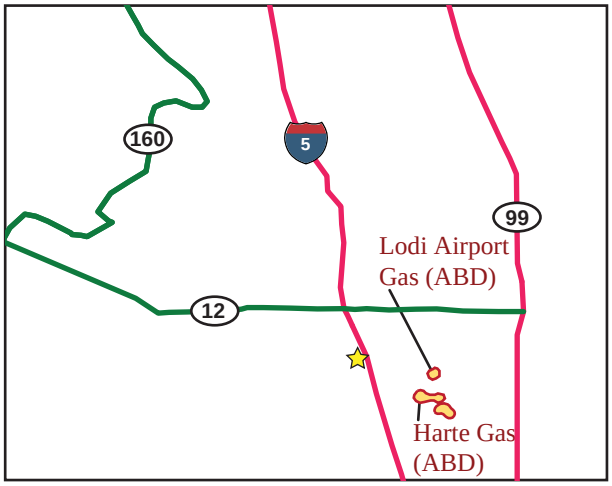




Harte Gas Field







STIG-LEC Facility

Source:
DOGGR, 1982

FIGURE F-14
DOMEGINE FORMATION
GAS FIELD STRUCTURES
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Attachment G
Geological Data on Injection and Confining Zones (Class II)

Application Requirements

For Class II wells, submit appropriate geological data on the injection zone and confining zones including lithologic description, geological name, thickness, depth, and fracture pressure.

Approach

Attachment G is not required for a Class I application.

Attachment H
Operating Data

Application Requirements

Submit the following proposed operating data for each well (including all those to be covered by area permits): (1) average and maximum daily rate and volume of the fluids to be injected; (2) average and maximum injection pressure; (3) nature of annulus fluid; (4) for Class I wells, source and analysis of the chemical, physical, radiological, and biological characteristics, including density and corrosiveness, of injection fluids; (5) for Class II wells, source and analysis of the physical and chemical characteristics of the injection fluid; (6) for Class III wells, a qualitative analysis and ranges in concentrations of all constituents of injected fluids. If the information is proprietary, maximum concentrations only may be submitted, but all records must be retained.

Approach

Although the STIG-1 and LEC-1 wells will have similar construction, they will be operated differently and will inject different quality water because they support plants that use different processes and operate differently. Additionally, there are routine operating data for the STIG-1 well from 2000. Therefore, each of the required items will discuss STIG-1 and LEC-1 separately.

The LEC-2 well, if drilled, will operate as a backup well to the two plant wells. It could take water either from waste lines or from the waste holding tanks at each plant.

Injection Rates and Volumes

The average and maximum daily rate and volume of the fluids to be injected is presented in this section.

STIG-1

The STIG-1 well has been operated routinely since 2000. Because the STIG facility supplies electricity when supplemental power is needed during periods of high demand, operation of the injection well varies. For example, during the California energy crisis of 2000-2001, the plant operated at nearly full capacity. Since then, however, the plant operates during periods of high electrical system demand with pre-scheduled maintenance shut-downs, primarily during the off-peak months.

During plant operation, water to be injected is stored in the onsite 60,000 gallon holding tank until there is a sufficient volume of water for injection. When the plant is operating, injections at STIG-1 have occurred between 1 and 22 days per month with the remainder of the wastewater returned to the WPCF, in accordance with the agreement with the City

(Appendix 2). Daily injection volumes, for the days injection occurs since injection well operation began in 2000, range from 344 to 1,078,400 gallons. The average injection volume is 143,670 gallons, excluding the days the injection did not occur. Figure H-1 shows the daily injection volumes at the STIG-1 well.

Daily injection flow rates at the STIG-1 well, also shown on Figure H-1, are relatively consistent. They range from 95.4 to 107.0 psi and average 99.7 for the 8 years of operation. The injection well has two 100 gpm pumps and routine injection generally only utilizes one pump. Therefore, this consistent injection flow rate is reasonable.

LEC-1

The LEC-1 well will support the LEC, which is planned to routinely operate to support baseload electricity demands. The injection rate of the well will depend on the number of times the water is cycled through the cooling tower. At 5 cycles, the maximum injection rate is expected to be 197 gpm. The maximum injection flow rate is expected to average 131 gpm at 7 cycles.

LEC-2

Specific injection volumes and rates cannot be determined because they will be dependent upon operational demands. However, at no time will the injection rate exceed the permitted rate of 225 gpm.

Average and Maximum Injection Pressures

The average and maximum injection pressure are presented in this section.

STIG-1

The monthly average and maximum historic injection pressures observed during routine operation, or non-testing conditions, are shown in Figure H-2. The historic operating data show that the injection pressures range between 261 (August 2004) and 506 (June 2008) psig. Although there is a general trend to increasing injection pressures over time, this is to be expected. Even with the increase in injection pressure over time, the injection pressure is considerably below the permitted pressure of 975 psig.

Several factors were considered for the increase in overall injection pressure, but no specific factor was isolated. No direct relationship was observed between changes in pressure after the well has not operated for up to several months. Additionally, no direct relationship could be identified between the amount of fluid injected and the injection pressure (Figure H-2). Therefore, the observed pressure buildup is attributed to the overall injection process.

LEC-1 and LEC-2

The range of injection pressures for the proposed wells is expected to be similar to what has been observed at the STIG-1 well.

Nature of the Annular Fluid

The annular fluid in the STIG-1 well is fresh water containing corrosion inhibitor and algaecide. Both the LEC-1 and LEC-2 will use the same annular fluid.

Geochemical Evaluation of the Injection Fluid

The source and analysis of the chemical, physical, radiological, and biological characteristics, including density and corrosiveness, of injection fluids for the STIG-1 and LEC-1 wells are presented in this section. The injection fluid of the LEC-2 well will be dependent upon which well is being substituted and so would be as either the STIG-1 or LEC-1 wells or an intermediate condition.

Water quality of the injected water at STIG-1 has been monitored since test injection began in the 1990s. LEC-1 projected water quality has been modeled to estimate individual parameters when the wastewater is injected. Both waste streams have undergone geochemical evaluation to assess the potential for interaction with the native Domengine Formation water. Water quality of each of these waste streams is discussed in the following.

The data presented herein assumes that each well is injecting fluids only from the plant it supports. If one well is injecting supplemental fluids from the other plant, the water quality of the injectate will be somewhere between the conditions of the two water quality endpoints, STIG-1 or LEC-1. The quantity of fluids transferred between injection wells will be monitored as part of the monitoring program presented in Attachment P. It will also be reported on the quarterly reports to EPA.

STIG-1

Prior to fluid being injected at the STIG-1 well, the geochemical evaluation of the Domengine groundwater and the STIG-1 injectate (Appendix 5) indicated that although there was some potential for minor precipitation of phosphate minerals, dispersion of the injectate within the Domengine injection zone was expected to reduce the potential for adversely affecting the interval. No other compatibility issues were identified (Don Michaels and Associates, 1994).

Data collected with the quarterly sampling of the injectate between 2002 and 2008 (Figure H-3) indicates that the quality of the water is generally consistent and where variability exists, the parameters are favorable. The one exception to this is the most recent (June 2008) alkalinity measurement, which is significant different from any preceding analysis. NCPA will be tracking this parameter to determine if this was an anomalous situation or an indication of a change in source water conditions.

In addition to the quarterly sampling, samples of the influent water received at STIG and of the injectate were collected and analyzed in 2006 for full Title 22 parameters (Appendix 6). These samples were collected and analyzed in response to a request by the Central Valley Regional Water Quality Control Board (CVRWQCB). These samples indicated that most constituents were lower in the injectate sample versus the influent sample, with the exception of 19 analytes (Table H-1). Copper and nitrate had the greatest increase in concentration, followed by mercury and phosphorous.

TABLE H-1
2007 Title 22 Sampling – Constituents with Effluent (Injection Water) Concentration Higher than Influent (From WPCF)

Constituent	Units	Analytical Results	
		Influent	Effluent
Greater than a four-fold Increase			
Copper	μg/L	1.52	10.4
Nitrate	mg/L	1.9	34.3
Less than a four-fold Increase			
Mercury	μg/L	0.0028	0.0072
Phosphorous, Total (as P)	mg/L	0.5	1.6
Less than a two-fold Increase			
Fluoride	mg/L	0.6	0.9
Iron	mg/L	0.23	0.32
Manganese	mg/L	0.07	0.11
Nickel	mg/L	0.08	0.09
Sodium	mg/L	184	196
Zinc	mg/L	0.06	0.07
Alkalinity (as $CaCO_3$)	mg/L	310	380
Bicarbonate	mg/L	380	460
Total Dissolved Solids (TDS)	mg/L	1020	1060
Specific Conductance (EC)	μmhos/cm	1440	1510
Chloride	mg/L	158	171
Sulfate	mg/L	97	122
Increase suggested, magnitude uncertain			
Cyanide	mg/L	not detected	0.042
Biochemical Oxygen Demand (BOD)	mg/L	2.9	77
Chemical Oxygen Demand (COD)	mg/L	not detected	50

Source: HydroScience Engineers, Inc. 2007. See Table 4 in the report (Appendix 6) for additional information on analytical methodology and practical quantitation limits.

Based on the operation of the STIG-1 well and generally consistent water quality of the injectate, the Domengine Formation appears to be remaining open to receiving injection water. The well has not had to have any kind of maintenance or rehabilitation during its operation. Although there is some pressure buildup at the STIG-1 well, the level of increase is consistent with what is expected from normal operation of an injection well.

Continued monitoring of the injection water and operation of the STIG-1 will provide NCPA and EPA with the required information to evaluate the well's performance.

LEC-1

The injectate of the LEC-1 is different than that of the STIG-1 well because the two plants generate electricity through very different processes. The LEC-1 injectate primarily will be cooling tower blowdown water that has circulated through the system 5 to 7 times. This will result in an injectate that is more concentrated in most constituents than the STIG-1 injectate. Table H-2 summarizes the estimated LEC-1 injectate based on the worst-case scenario of 7 cycles of concentration, the Domengine Formation sample collected prior to any injection, and several representative samples from the STIG-1 injectate collected over a period of years.

TABLE H-2
Summary of Water Quality Data from Samples Collected Periodically During Well Operation

Parameter[1]	Domingine Formation[2]	LEC-1[2]	NCPA STIG-1[3]					
		Projected	03/20/08	03/22/07	03/15/06	02/22/05	03/24/04	03/26/03
Na	3,200	1771	162	90	147	147	86	107
K	46	145.9	25.0	12.0	28.0	22.0	15.0	18.0
Ca	761	423.7	54.0	25.0	49.0	43.0	31.0	35.0
Mg	86	13.1	20.0	10.0	19.0	20.0	12.0	14.0
Cl	7,000	2384	148	66	114	132	87	98
Alkalinity		107.3	280.0	190.0	320.0	220.0	129.0	156.0
pH	7.85	7.50	7.80	7.70	7.70	7.60	7.30	6.50
SO4	8.0	869	93	19	69	76	49	43
NO3N		389.02	60.60	5.10	53.20	74.40	56.00	1.10
F		0.00	0.40	0.20	0.10	0.30	0.20	0.50
SiO2	16.5	148.2	85.0	60.0	71.0	92.0	51.0	55.0
TDS	14,066	6256	760	450	760	780	527	522
Conductivity	17,780	12157	1260	646	1110	1110	880	906

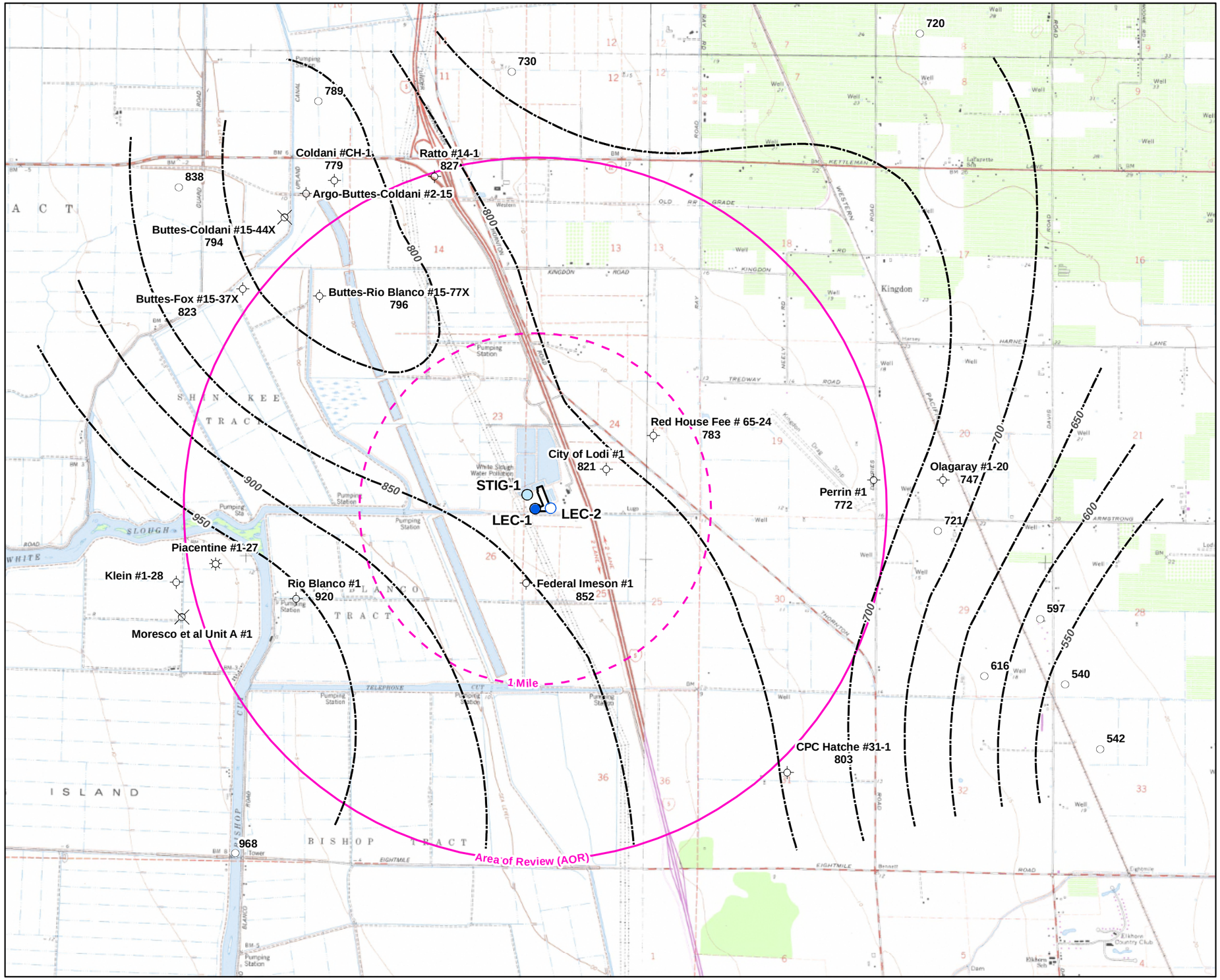
[1] Units are in mg/L, except for pH (standard units) and conductivity (μmhos/cm). r quality is provided for the two plant injection wells. Quality of water injected into the backup well will be somewhere between these two, depending upon the plant providing the injection water.

[2] Data from LEC AFC (2008)

[3] Data from NCPA STIG-1 quarterly reports

Geochemical evaluation of the compatibility of the LEC-1 injectate and the Domengine Formation water was conducted (Appendix 7). This evaluation indicated that no precipitates are expected to form. The one parameter of concern is nitrate. The proposed concentration of 253.7 mg/L could stimulate the growth of nitrogen-reducing bacteria in and around the LEC-1 well screen if organic carbon is also increased. However, because there is not analysis of organic carbon in the blowdown water, this cannot be predicted at this time. It is recommended that organic carbon be analyzed in the injectate water and re-assessed prior to routine injection.

Figures



LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

- Dry Hole
- Gas Well, Abandoned
- Gas Well, Producing Gas
- Other Well Outside Study Area
- Domengine Thickness (ft)
- 1 Mile
- Area of Review (AOR) - 2 Miles
- LEC Project Site

Notes:
1. Source: Class 1 Underground Injection Lodi Control Well Permit Application for October, 1993.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE I-1
DOMENGINE FORMATION ISOPACH MAP
STIG-LEC FACILITY
LODI, CALIFORNIA

CH2MHILL

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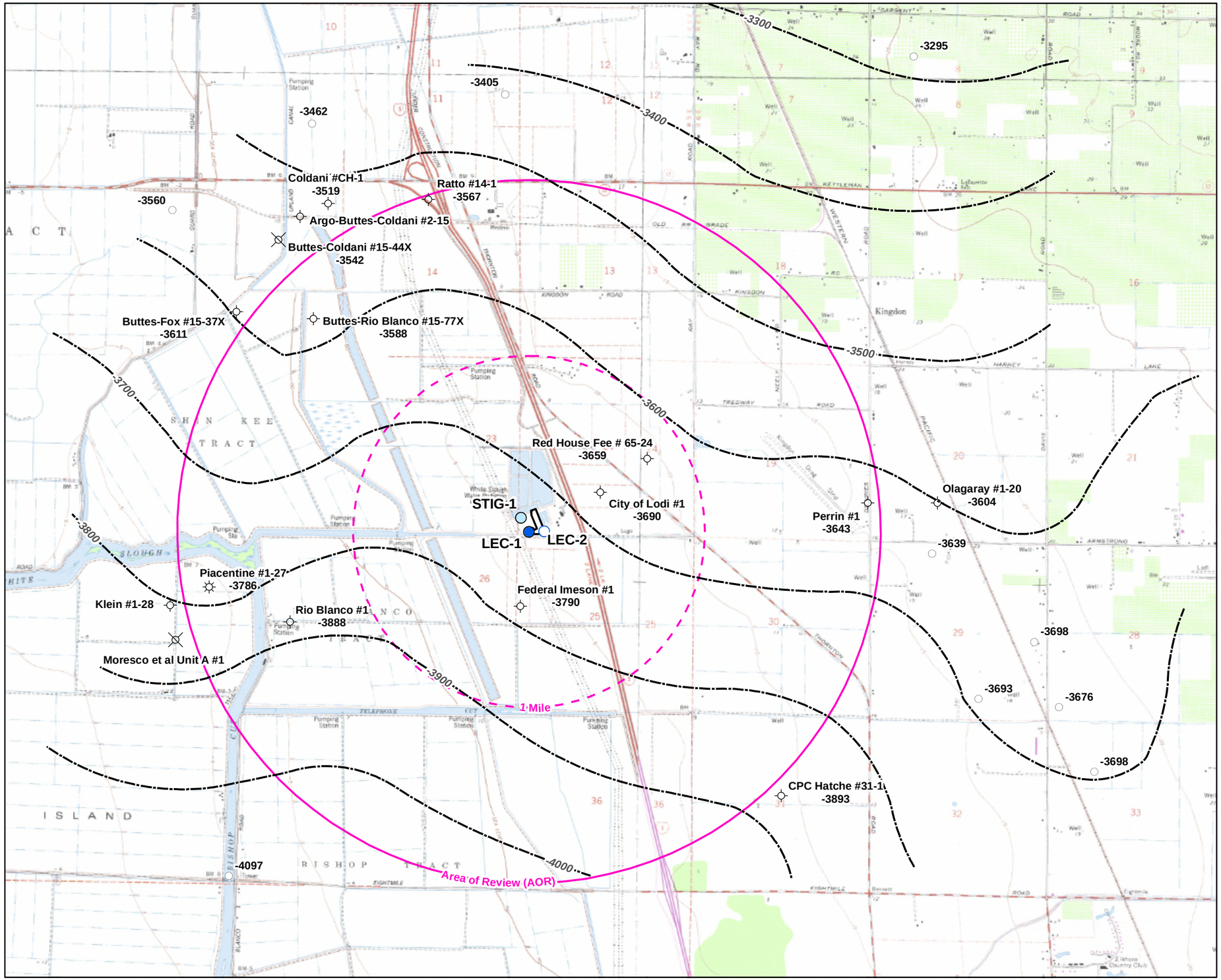

LEGEND

- New Injection Well Location (LEC-1)
- Existing Injection Well (STIG-1)
- Potential Backup Injection Well Location (LEC-2)

Existing Well Types

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- 1 Mile
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Notes:
1. Source: Class 1 Underground Injection Lodi Control Well Permit Application for October, 1993.

This base map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,500 3,000
Feet

FIGURE I-2
DOMENGINE FORMATION STRUCTURE CONTOUR MAP
STIG-LEC FACILITY
LODI, CALIFORNIA

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Attachment I
Formation Testing Program

Application Requirements

The proposed formation testing program for Class I wells must be designed to obtain data on fluid pressure, temperature, fracture pressure, other physical, chemical, and radiological characteristics of the injection matrix and physical and chemical characteristics of the formation fluids.

Approach

The tests and work described below will be performed during construction to obtain the information necessary to support the issuance of a UIC permit following completion of the LEC-1 well and the LEC-2 backup well. Discussion relative to LEC-1 in this section would also apply to LEC-2, if it is drilled.

The existing testing program will be continued for the STIG-1 well (annual mechanical integrity as presented in Appendix 7 and monitoring and quarterly reporting), but future discussions may occur with EPA to confer about continuous pressure monitoring versus annual testing.

Determination of Fluid Pressure in the Confining and Injection Zones

Fluid pressure in the upper confining zone, the Nortonville Shale, will be determined during the drilling of the well. Following successful installation and cementing of the 7-inch casing into the Nortonville Shale at an expected depth of about 3,660 feet bgs, the borehole will be advanced 2 to 3 feet below the casing shoe into the shale. At that time, a leakoff test will be performed. The pressure in the well bore will be measured with a downhole drillstem test (DST) pressure recorder. Pressure in the casing will be allowed to stabilize under static conditions, will then be increased in 100 psi increments several times, and the pressure will be recorded as it falls back to the "true initial pressure" at the bottom of the casing in the shale. The data from the tests will be compared to each other, and will demonstrate the actual pressure in the confining zone prior to injection operations. The comparison of the pressure falloff data from the different tests will demonstrate whether the confining bed has the needed integrity to prevent vertical migration of fluids out of the injection zone. The test will be terminated before breakdown pressure is reached so that the integrity of the confining bed will not be impacted.

Fluid pressure in the injection zone will be calculated following completion of construction of the LEC-1 well by allowing the well to sit undisturbed and measuring wellhead pressure,

if present, or by determining the height of the fresh water column in the well during shut-in conditions and calculating the hydrostatic pressure on the zone. Pressures on the LEC-1 well will be monitored and recorded while the STIG-1 well is injecting and when it is not for a period of 48 hours prior to injection testing of the LEC-1 well. This will provide data both on the pressure in the injection zone in shut in conditions and on the overall maximum pressures to be expected during operation of both injection wells.

Determination of Temperature in the Injection Zone

Temperature in the injection zone will be determined by running a temperature log in the well upon completion of construction of the well, and prior to injection operations.

Determination of Fracture Pressure in the Injection Zone

Fracture pressure in the injection zone will be calculated using an assumed general fracture gradient of 0.73 psi per foot. The Domengine Formation lies at a depth of about 3,750 to 4,585 feet. Fracture pressures at those depths are therefore estimated at approximately 2,737 psi and 3,347 psi, respectively. Based on the proposed perforated interval of the LEC-1 (and LEC-2) well, the estimate fracture pressure would be about 2,993 psi. Considering that the density of the proposed injection fluid is about 1.04, the resulting hydrostatic pressure at the top of the completion interval is 1,991.7 psi. Therefore, a minimum injection surface pressure of 1,178 psi would be necessary to fracture the LEC-1 completion interval.

Determination of Physical, Chemical and Radiological Characteristics of the Injection Zone

Sampling and testing of formation matrix and water from the injection zone will be conducted.

Analysis of Injection Zone Formation Matrix

As the borehole for the LEC-1 well is advanced through the Domengine Formation, attempts will be made to collect whole core through the proposed injection interval of roughly 4,220 to 4,575 feet bgs. If the formation is too soft to core—a likely condition since the STIG-1 well encountered flowing, unconsolidated sands in the injection interval of that well—then a bulk sample from cuttings circulated to the surface will be collected for analysis.

The mineralogy, grain size distribution, permeability, and hydraulic conductivity of the Domengine Formation matrix will be determined, as well as for the Nortonville Shale.

Analysis of Representative Formation Water Sample

The physical and chemical characteristics of the injection zone formation fluids are represented by chemical analyses performed on the native water in the Domengine Formation from prior to initiation of injection activity in the immediate area, and proposed

sampling and analysis of fluid present in the injection zone at the new well following construction.

Formation water samples were collected from the Domengine Formation (i.e. the injection zone for the LEC-1 well) at the adjacent STIG-1 well when it was installed in 1993. The results of the laboratory analyses of that representative sampling indicated that the natural formation water had a TDS of 14,066 mg/L, consisting primarily of sodium (3,200 mg/L), chlorine (7,000 mg/L) with calcium (761 mg/L), magnesium (86 mg/L), and potassium (46 mg/L) and trace amounts of other naturally occurring dissolved metals. Other ions present included silica dioxide (SiO_2) at 16.5 mg/L, bicarbonate (HCO_3) at 62 mg/L and sulfate (SO_4) at 8.0 mg/L. Radiological activity was not reported in the original samples from the formation. Table I-1 summarizes these and other native water quality parameters of the Domengine Formation.

TABLE I-1
Natural Domengine Formation Water Quality at STIG-1

Parameter	Measurement	Units
Bicarbonate	62	mg/L[a]
Chloride	7,000	mg/L
Calcium	761	mg/L
Magnesium	86	mg/L
pH	7.85	s.u.[b]
Potassium	46	mg/L
Silica Dioxide	16.5	mg/L
Sodium	3,200	mg/L
Sulfate	8.0	mg/L
Total Dissolved Solids	14,066	mg/L
Total Suspended Solids	19	mg/L
Specific Conductance	17,780	µmhos/cm[c]

[a]milligrams per liter
[b]standard units
[c]microsiemens per centimeter
Source: NCPA, 1993

Domengine Formation water samples produced from the perforated interval (proposed to be roughly 4,220 to 4,575 feet bgs) of the LEC-1 well will be collected by the drilling contractor during a production test to be performed following completion of the well. Those samples will be obtained following construction and development of the new well. The well will be pumped to remove a quantity of water equal to at least three times the volume of fluids lost during drilling and any development and stimulation activities. Regardless of the amount of water to be produced prior to sampling, pumping will continue until field

measurements of pH, conductivity, and temperature indicate that the water chemistry has been stable for at least 2 hours.

Water quality in the Domengine Formation at the LEC-1 well is expected to be more like the injected water from the STIG-1 well, which is about 800 feet away and has been injecting since 1993. TDS is expected to be much lower than the native groundwater, and should be similar to the water quality proposed for injection at LEC-1. Samples of the fluid in the injection zone will be collected following well development and analyzed to allow for an evaluation of the compatibility of the proposed injected fluids with the injection zone matrix and waters in the injection zone. Samples will be analyzed for Resource Conservation and Recovery Act of 1976 (RCRA) metals; common ions like carbonate, bicarbonate, nitrates, sulfates, and phosphate;, and for coliform bacteria, radiological activity, and general water chemistry parameters like pH, TDS, and TSS. Standard analytical methods and EPA-accepted sample collection protocols will be used and documented.

Hydrogeology of the Injection Zone (Domengine Formation)

The most relevant existing data concerning the character of the proposed injection zone for the LEC-1 well was collected during the drilling, testing, and completion of the nearby STIG-1 well. The following discussion of injection zone hydrogeology is based in large part on information gathered from the construction and testing of that well. As the LEC-1 well is constructed and tested prior to initiation of injection operations, the actual conditions at the new well will be verified through testing.

Thickness

The Domengine Formation is 831 feet thick in the STIG-1 well. Based on information obtained from other wells in the area, that thickness ranges between a minimum of about 780 feet to a maximum of about 910 feet within a radial distance of 1 mile from the LEC-1 location (see Figure I-1).

The Domengine Formation as encountered in the STIG-1 well consisted of three primary sand bodies with thicknesses of 191 feet, 190 feet and 346 feet, respectively (top to bottom). These sands bodies were separated by 70-foot and 34-foot thick shaley intervals. The lowermost of the sand bodies is the primary injection interval at STIG-1 and is proposed as the injection interval for LEC-1.

Age

The Domengine Formation is of Middle Eocene age, or about 45 million years old.

Lithology

The Domengine Formation sands are mainly composed of light gray to white, very coarse to very fine grained, generally well sorted, unconsolidated, that are massively bedded. The finer grained materials separating the primary sand bodies consist of gray-brown shale and siltstones that may include minor amounts of lignite.

Mineralogy

Quartz is the predominant mineral in the Domengine sands. Small amounts of varicolored lithic fragments, pyrite, and glauconite may also be present. The shaley intervals consist primarily of clay minerals, and trace amounts of pyrite and glauconite.

Structure

The Domengine Formation near the injection well location dips gently about 1.5 degrees to the southwest. No other significant geologic structures, such as faults or folds, occur within a distance of a mile from the well. Figure I-2 is a map of the structural contours on top of the Domengine Formation.

Description of Vertical and Lateral Continuity

The Domengine Formation is laterally continuous throughout this part of the Central Valley depositional basin. The unit is readily correlated in electric logs, and has been encountered by deep wells for many miles in all directions from this location. Outcrops of the Domengine, and the upper confining layer Nortonville Shale, occur in the Potrero Hills about 30 miles west of the LEC-1 site, and at Mt. Diablo near the old town site of Nortonville.

An isopach map of the Domengine Formation, presented at Figure I-1, shows that the formation thickens to the southwest, toward the center of the depositional basin.

Hydrologic Parameters

1. **Permeability**—The permeability of the Domengine sands in the completion interval of the STIG-1 well was estimated to be 54.4 md, and a reservoir value of 12,500 millidarcies per foot (md/ft) was obtained from the initial well testing, based on an effective completion interval length of 230 feet. Since the STIG-1 well is only about 800 feet from the proposed LEC-1, well conditions should be similar, but, as stated above, this will be evaluated and determined during drilling and testing of the LEC-1 well.

2. **Porosity**—Analysis of the Neutron and Density Logs performed on the STIG-1 completion zone indicated a porosity ranging between 26.2 and 45.8 percent, with an average porosity being 35.3 percent. Porosity within the injection zone at the LEC-1 well will be verified through geophysical logging and sampling of formation materials during drilling of the well.

3. **Reservoir Pressure**—The formation pressures for the top and bottom of the Domengine Formation at the STIG-1 well were calculated, using a hydrostatic gradient of 0.433 psi/ft, indicating that the pressure at the top and bottom of the formation ranged from 1,614 to 1,974 psi, respectively. Additionally, a measured reservoir pressure of 1,698 psi was obtained at a subsurface depth of 3,986 feet in the STIG-1 well at the conclusion of the shut-in period following the injection test on June 5, 1993. Considering the calculated hydrostatic pressure of 1,726 psi at that depth, the shut-in pressure indicated the Domengine reservoir pressure initially was about 28 psi below hydrostatic. Since injection began, annular pressure tests have been performed on STIG-1. Currently, bottom hole shut-in pressure is about 1764 psi. After injecting 100 gpm for 6 hours, pressure builds up to about 2,173 psi, but within 3 hours of stopping injection and

shutting in the well, it drops back to about 1,764 psi. The injection zone has been pressurized by injection at STIG-1 but only a minimal amount. As with other injection zone parameters necessary to complete the UIC permitting process, actual reservoir pressures will be determined on LEC-1 as it is completed.

4. **Storage Coefficient**—The storage coefficient for the Domengine was calculated using the porosity determined form the geophysical logs on the STIG-1 well and the completion interval thickness, and an assumed value of 7.5 x 10-6 psi-1 for compressibility of the formation water (a literature average value). The product of these values is defined as the storage coefficient, and was calculated to be about 6×10^{-4} feet psi-1.
5. **Oil/Water Saturation**—The Domengine Formation is 100 percent water saturated in this area.

Injectivity Testing and Geophysical Logging

Injectivity tests will be performed in the LEC-1 well upon completion of construction. A step-rate test will be conducted following successful completion of the pre-injection temperature log. Water filtered and treated for injection into the STIG-1 well will be used for the LEC-1 injectivity test since that will most closely match the chemical characteristics of the proposed waste stream for the LEC-1 well. All temperature logs will be run at a rate of no more than 100 feet per minute (fpm). Pressure in the wellbore and at the wellhead will be recorded continuously throughout the step-rate tests. Flow rate will be continuously recorded at the wellhead during the test.

Injection will begin after a pressure monitoring tool is placed in the well at a depth of about 4,000 feet. The flow rate will be increased until the planned 225 gpm injection rate for the well is achieved. The 225 gpm injection rate will be maintained for a minimum of 3 hours, then a spinner log and a temperature log (run at 80 fpm) will be conducted from the bottom of the 7-inch casing shoe at about 3,660 feet to total depth. Upon completion of the spinner and temperature logging at the 225 gpm step, injection will be reduced to 150 gpm and the spinner log repeated twice more over the same depth interval. Upon completion of the logging at the 150 gpm step, flow will be further reduced to 100 gpm, and the spinner log and temperature log will be repeated over the same depth interval. The pressure logging tool will be placed near the bottom of the well, and injection will continue for 30 minutes, then the pump will be turned off and the well shut in. The pressure fall-off will be recorded until it stabilizes within 3 psi of the pressure in the wellbore recorded immediately prior to initiation of the test.

Direction and Rate of Groundwater Movement in Deep Marine Sandstones

The direction of movement of formation waters within the deep marine sandstones of this region, including within the Domengine Formation, is probably strongly influenced by the structural features. Structural dip is to the southwest, and the areas of potential recharge are located at higher elevations positioned to the northeast toward the Sierra foothills.

As to the present rate of lateral movement of these shallow ground waters and deep formation waters, there are no available measurements. However, it is known that the changes in groundwater elevation over this area are very gradual, typically less than 5 feet over a lateral distance of 1 mile. Also, the structural dip of the deep formations is known to be less than 2 degrees in this area. These very gentle gradients suggest that the rate of lateral movement of both the shallow and deep waters in this area is insignificant.

Direction and Rate of Injected Fluid Migration

The direction of injectate fluid migration will be essentially radial from the proposed injection well, as any existing lateral variations in the local hydraulic gradient within the Domengine will be dominated by that injection. The estimated rate of expansion of the injectate front radially outward from the well, assuming a continuous injection rate of 200 gpm into an exposed interval of 230 feet of sand having 35 percent porosity, will average 71 ft/yr for the first 10 years, and will be reduced to 25/ft per year by the end of the 20th year. The location of that injectate front at the end of 20 years is calculated to be at an average radial distance of 1,008 feet from the well.

Figures

Attachment J
Stimulation Program

Application Requirements

Outline any proposed stimulation program.

Approach

This section addresses well stimulations that could be conducted at the existing or future wells.

Anticipated Initial Conditions at the LEC-1 Well

Considering the results of the initial testing and more than a decade of successful operation of the STIG-1 well, no injection zone stimulation program is likely to be necessary for the LEC-1 well. The Domengine Formation sands at the injection site are moderately permeable, and so long as the injected fluids are filtered and generally free of particulates, clogging should be minimized.

Geochemical analysis (see Attachment H) indicates that wastewater being injected at STIG-1 and that proposed to be injected at LEC-1 well should be chemically compatible with the injection zone matrix. Therefore, no stimulation should be needed at LEC-1 and the backup well, if drilled, other than general well cleaning and development to remove any residual drill mud from the borehole immediately following construction of the well.

Well development at LEC-1 and the backup well will commence immediately following casing perforation, and the installation of the screen and sand pack in the injection zone. The well will be pumped until the drilling mud has been removed from the well, and water is free of any visible particulate matter. Surging and/or jetting the screened section of the well may be necessary to remove particulate matter and drill mud from the sand pack.

Conditions That Could Result in Stimulation in the Future

As injection begins and continues at STIG-1, LEC-1, or the backup well, well stimulation may be required to increase injectivity to initial values. Continuous monitoring and recording of injection rates and pressures will allow for ongoing determination of injectivity under normal operating conditions. A reduction in injectivity will indicate plugging of either the injection matrix or the sand pack in the well. Should that occur, the well will be tested to assess whether the well has partially filled in due to particulates in the injection stream or back flowing from the injection zone during periods of down time, or to assess whether the screen and/or sand pack has clogged or collapsed. Should clogging be documented, samples of the particulates will be collected and tested for chemical

composition if inorganic, or to assess what organism is involved if the clogging agent is organic. Depending on the nature of the clogging agent, a stimulation program will be designed and discussed with the Agency prior to implementation. Potential stimulation measures might involve acidizing the well to dissolve inorganic particulates or sterilization and disinfection if the agent is organic. If the screen or pack has collapsed it may be necessary to remove and rebuild it.

Methods to Minimize Future Stimulation Needs

To minimize the frequency or likelihood of well or injection zone damage occurring, which would require stimulation in the future, the wastewater will be continuously filtered to the less than 3-micron size to reduce the potential for clogging; the chemistry of the waste water to be injected will be continuously monitored and kept within the range of known stable conditions for the Domengine Formation in this area; and biocides and corrosion inhibitors will be added to the waste water to prevent organic growth or chemical scaling or precipitation in the system. Appendix 8 contains the MSDS for additives to the injected fluid.

Attachment K
Injection Procedures

Application Requirements

Describe the proposed injection procedures including pump, surge, tank, etc.

Approach

Injection procedures are well established for the STIG-1 well. These are described below. General descriptions of the injection procedures for the LEC-1 well and the possible backup well, LEC-2, are being developed. Both are discussed below.

Operational Overview

NCPA currently operates the STIG plant when electricity is needed during high demand periods. The STIG-1 well, therefore, only injects waste when the STIG plant is operational and when the required 20 percent injection occurs.

The LEC is planned to meet routine power demands. The LEC-1 well will dispose of nonhazardous process wastewater from the LEC facility. It will be constructed, operated, maintained, and monitored in a manner consistent with STIG-1. The LEC-1 well is planned to be installed and tested prior to plant construction.

The third well, LEC-2, may be installed at a future date to serve as a back-up well to both the LEC-1 and STIG-1 wells. This is discussed more fully in Attachment O, Plan for Well Failures.

STIG-1

When operating, the STIG-1 well injects approximately 100 gpm, based on the 2008 first quarter monitoring report submitted to USEPA, which is well-below the permitted rate of 200 gpm. Historic injection pressures range from 261 to 506 pounds per square inch (psi), which is also well-below the maximum permitted wellhead injection pressure of 975 psi. The historic injection pressures and monthly injection rates are summarized in Figure K-1.

Under current conditions, at least 20 percent of plant wastewater is collected in a 60,000-gallon wastewater storage tank, where its contents are tested to ensure compliance with the operating permit before being discharged to the injection well via two 100-gpm wastewater injection pumps. Current injection limitations include the following:

- Maximum flow rate 200 gpm
- pH between 6.5 and 8.5
- Silica <120 ppm
- Injection water temperature <100°F

LEC-1

The LEC-1 well will operate at slightly higher rates than STIG-1 and will be permitted for an injection rate of 225 gpm. Injection pressures are planned to be similar to those measured at STIG-1. Other permit limitations for the new well have not been established.

Injection Rates

STIG-1

The currently designed and installed water balance system for the STIG plant (Figure K-2) demonstrates that the daily average injection rate is normally at or about 100 gpm. The range of daily average injection rates, when assuming plant full load operations under infrequent but anticipated conditions, may extend from zero to a maximum of approximately 183 gpm. On a short term (hourly) basis, the injection rates may range between the single injection well pump operation rate of 100 gpm and the maximum possible delivery rate of 200 gpm, with both injection well pumps in service.

LEC-1

Circulating water system blowdown at the LEC plant will consist of the tertiary-treated makeup water from the WPCF and other recovered process wastewater streams from the LEC that have been concentrated by evaporative losses in the cooling tower, along with the chemicals added to the circulating water. The cooling tower concentrates these streams near the mineral solubility limit for the constituents of concern (calcium, silica, and TDS). This concentrated water must then be removed from the cooling tower via blowdown to prevent the formation of mineral scale in heat transfer equipment. The chemicals added to the circulating water control scaling and biofouling of the cooling tower and control corrosion of the circulating water piping and intercooler. Cooling tower blowdown rates will be controlled at approximately five cycles of concentration as a result of in-line water conductivity and constituency analyzers. Blowdown rates are expected to be between 125 and 225 gpm, depending upon cooling tower cycles of concentration. Two 150-gpm injection well pumps designed to draw suction from the cooling water tower basin sump will discharge through two 100-percent-flow prefilters and then into the injection well. Figures K-3a and K-3b show the planned water balance system for the LEC plant. The final plant design will be completed when the CEC is close to or has issued its permit for the LEC facility.

LEC-1 injection rates will vary based on the number of cooling tower circulation cycles. Estimated injection flow rates for 5 cycles of circulation is 197 gpm. For 7 cycles of circulation, injection flow rates are expected to be 131 gpm. LEC-1 injection flow rates will not exceed the proposed permitted rate of 225 gpm.

LEC-2

LEC-2 injection rates will be permitted to not exceed 225 gpm. The injection rates at which the well would operate would be determined by the well being backed up or supplemented.

Injection Pressures

STIG-1

The injection initially indicated that the STIG-1 well injection rate of 100 gpm would require an injection pressure of approximately 210 psi and the maximum injection rate of 200 gpm would have an injection pressure of about 325 psi. Figure K-1 shows the relationship between injection pressure and injection rate for the operating data collected since 2000. This shows that overall, injection rates and pressures are consistent and do not show a direct relationship. Figure K-4 shows the historic injection pressure and measured well head pressures at the STIG-1 well. No overall increase in wellhead pressure has been seen over the operating period of the well.

Experiences elsewhere suggest that those initial surface pressures will have to be increased gradually with time, in order to continue the fluids disposal at a constant flow rate. Then, after having performed appropriate downhole stimulation treatments (see Attachment J), the surface pressures can be returned to near-initial conditions. These same pressures are expected to be found on the new injection well.

However, the operating permit does not allow the surface pressure be allowed to exceed 975 psi, which historic data show it has not. This is the recommended surface pressure limitation proposed after an extensive analysis was performed to determine the pressure required to initiate fracturing of the confining layer above the injection zone. For a detailed description of that analysis, refer to Section 10 of the Mesquite Report provided in Appendix 9 of this Application.

LEC-1 and LEC-2

Pressure increases at the LEC-1 well (and LEC-2 well, if installed) are predicted to not exceed 800 psi over the 30 year life of the well (Figure K-5)

Waste Streams

The sources of the wastewater to be injected in each well are discussed below. The water quality of the injected wastewater was presented in Attachment H.

STIG-1

Brine reject from the ultrafiltration units, brine from the reverse osmosis units, and blowdown from the cooling towers collectively comprise about 98 percent of the treated wastewaters that are injected. The other 2 percent of the liquid wastes intended for injection consist of both continuous and intermittent blowdowns from the Heat Recovery Boilers.

No other waste streams are injected. Filtrate from the chamber filter press and multimedia filters are collected and routed back to the feedwater storage tank. Periodic effluent from cleaning the reverse osmosis membrane systems and de minimis losses collected in the Neutralization and Chemical Drain System are sent to the White Slough WPCF for treatment. Storm water, service water, and condensate and other liquids in the plant drains are collected separately, passed through an oil-water separator, and pumped to the White

Slough WPCF industrial system. None of these wastes are injected, and neither are cleaning wastes from the Closed Cooling Water System.

LEC-1

Circulating water system blowdown will consist of the tertiary-treated makeup water from the WPCF and other recovered process wastewater streams from the LEC that have been concentrated by evaporative losses in the cooling tower, along with the chemicals added to the circulating water. The cooling tower concentrates these streams near the mineral solubility limit for the constituents of concern (calcium, silica, and TDS). This concentrated water must then be removed from the cooling tower via blowdown to prevent the formation of mineral scale in heat transfer equipment. The chemicals added to the circulating water control scaling and biofouling of the cooling tower and control corrosion of the circulating water piping and intercooler. Cooling tower blowdown will be directed to an onsite Class I UIW.

LEC-2

Waste stream characteristics of the LEC-2 well will depend on which plant well is being backed up.

Figures

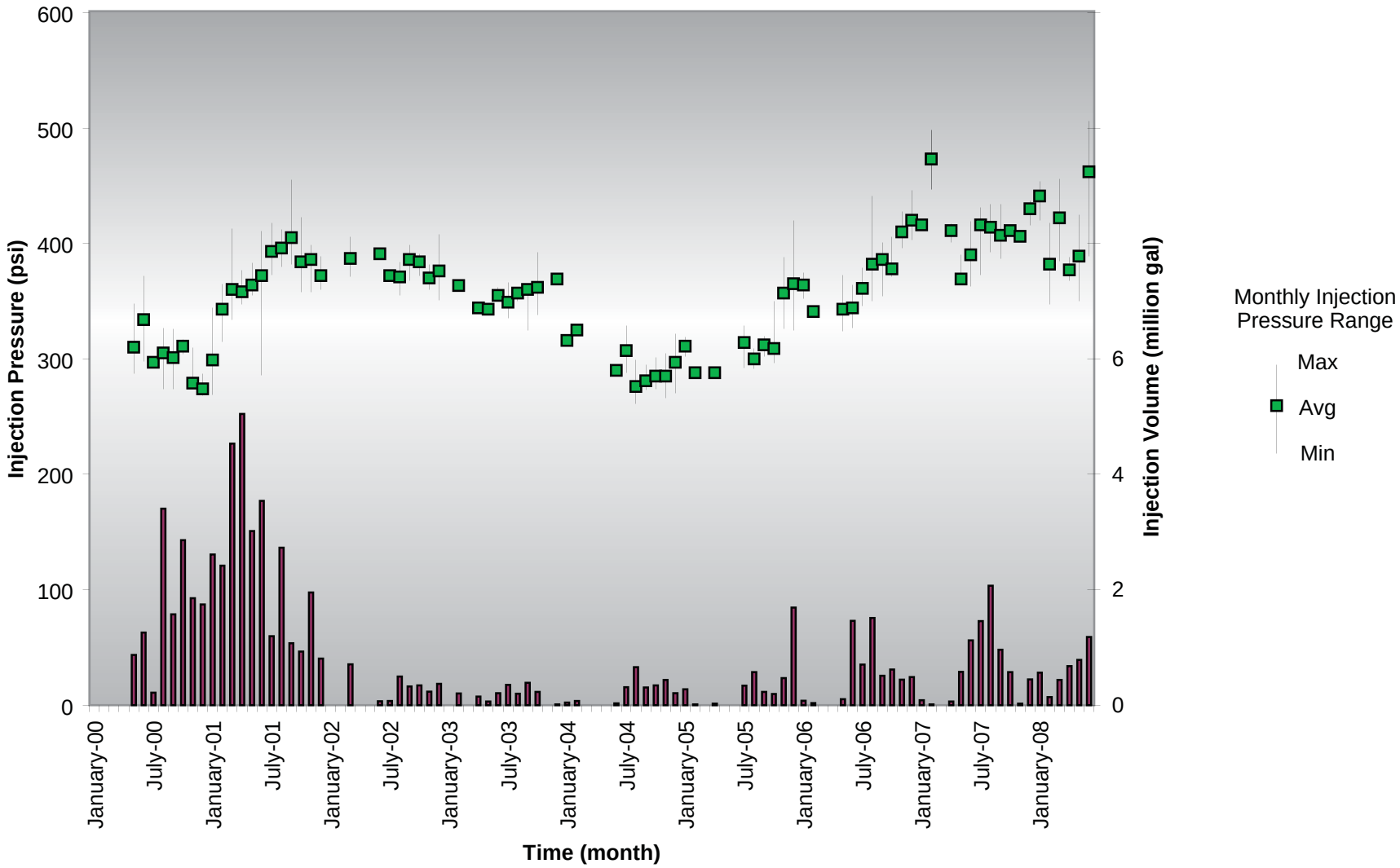
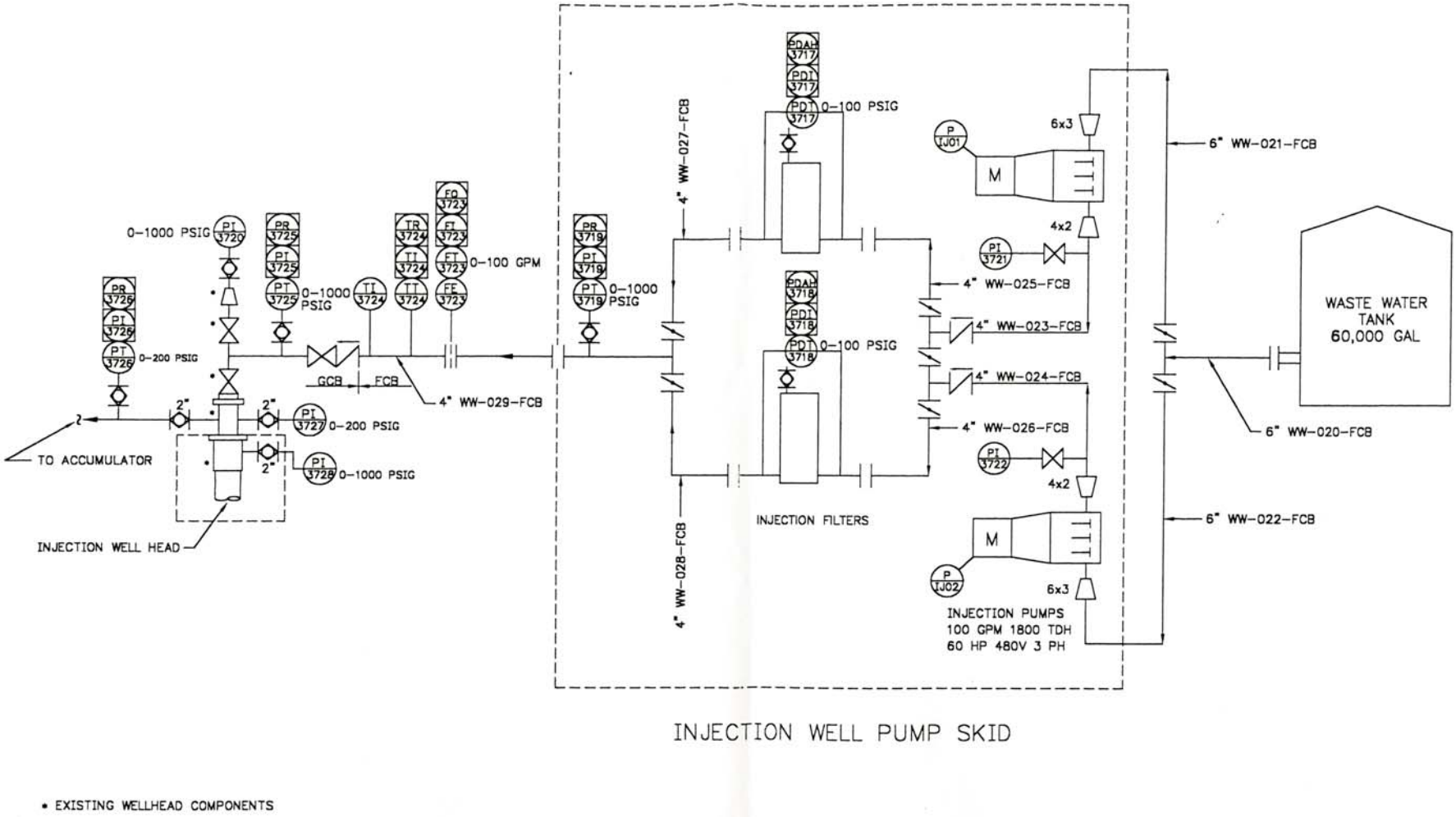


FIGURE K-1
STIG-1 2000–2008 MONTHLY INJECTION PRESSURES AND VOLUMES
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

CH2MHILL



Source:
Northern California Power Agency, May 1993

FIGURE K-2
STIG INJECTION WATER SYSTEM
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

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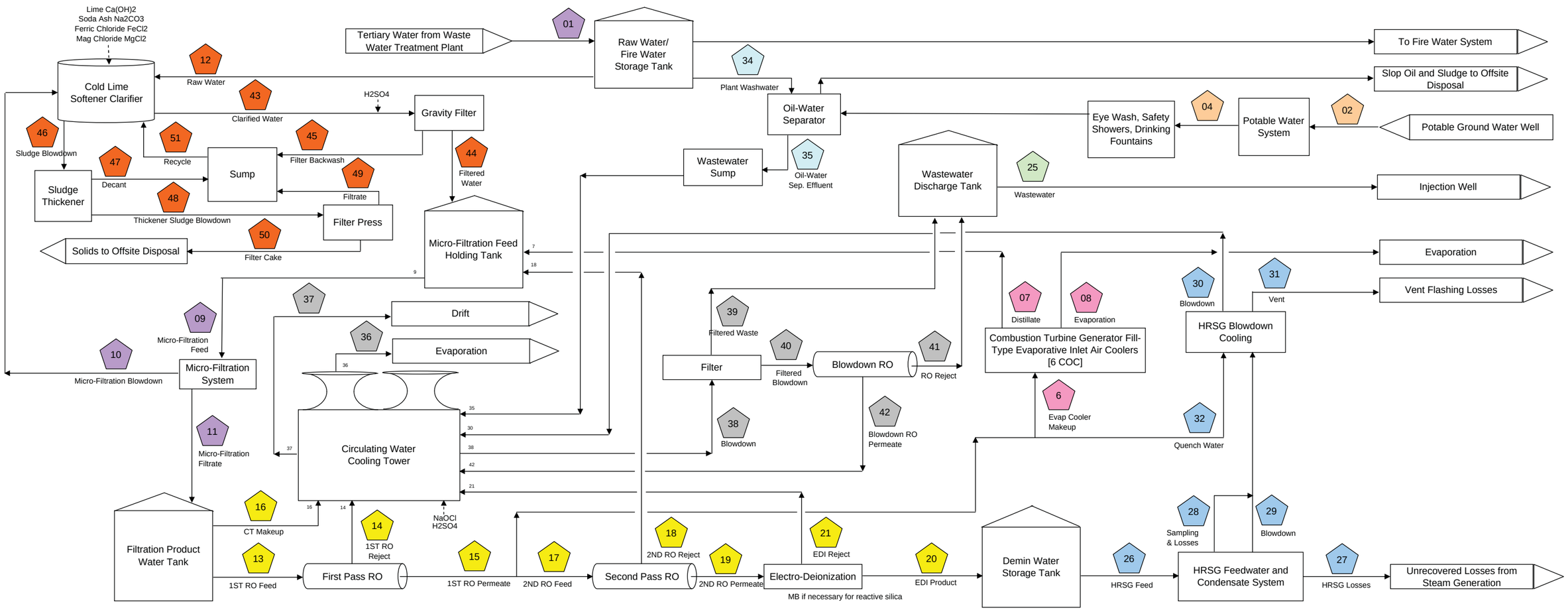

Note: The legend/key to the water balance diagram is found in Section 2, Project Description, Table 2.1-1.

FIGURE K-3a
WATER BALANCE DIAGRAM
LODI ENERGY CENTER
LODI, CALIFORNIA

Source: Worley Parsons LTD, LODI-0-DC-510-ME-0002D, 08-20-08

CH2MHILL

Calculation Cover Sheet

Customer	NCPA	**Proj No**	**52007002**
Project Title	Lodi Expansion Combined Cycle Project	**Calc No**	**LODI-0-DC-510-ME-0002**
Calculation Title	NCPA Lodi Water Balance Calculation	**Phase/CTR**	
Elec File Location			
Project File Location		**Page** 2	**of** 2

Rev	Date	By	Checked	Rev	Date	By	Checked
C	8-Jul-08	S. Stern	M. Pelletier	D	20-Aug-08	S. Stern	M. Pelletier

	Case (Heat Balance Case)	Duct Burning Status	Evaporative Cooler Status	Dry Bulb Temperature °F	Relative Humidity (%)	Wet Bulb Temperature °F	
Case 1	Annual Average	OFF	ON	61.2	66.8	54.8	
Case 2	Summer Typical	OFF	ON	94.0	27.5	68.9	
Case 3	Summer Maximum	OFF	ON	107.7	18.2	72.9	
Case 4	Winter Typical	OFF	OFF	32.6	74.0	29.7	
Case 5	Winter Minimum	OFF	OFF	23.7	81.0	22.1	
Case 6	Summer Maximum (Fired)	ON	ON	107.7	18.2	72.9	

Flow rates are daily average values in gpm

		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Stream No.	Stream Description	Annual Average	Summer Typical	Summer Maximum	Winter Typical	Winter Minimum	Summer Maximum (Fired)
1	Influent from WWTP	856	1196	1351	657	586	1528
2	Potable Ground Water Well Inlet	1	1	1	1	1	1
4	Eye Wash/Safety Shower/Drinking Water	1	1	1	1	1	1
6	CTG Evaporative Cooler Makeup	11	40	54	0	0	54
7	CTG Evaporative Cooler Blowdown	2	7	9	0	0	9
8	CTG Evaporative Cooler Evaporation	9	33	45	0	0	45
9	Micro-Filtration Feed	1008	1393	1569	783	704	1784
10	Micro-Filtration Blowdown	101	139	157	78	70	178
11	Micro-Filtration Filtrate	907	1254	1413	705	633	1606
12	Clarifier Feed	846	1186	1341	647	576	1518
13	1st Pass RO Feed	103	108	110	101	102	137
14	1st Pass RO Reject	26	27	27	25	25	34
15	1st Pass RO Permeate	77	81	82	76	76	103
16	Cooling Tower Feed	804	1146	1303	603	532	1469
17	2nd Pass RO Feed	35	34	34	35	35	42
18	2nd Pass RO Reject	3	3	3	4	4	4
19	2nd Pass RO Permeate (EDI Feed)	31	31	31	32	32	38
20	EDI Product	28	28	27	28	28	34
21	EDI Reject	3	3	3	3	3	4
25	Wastewater to Injection Well	103	143	161	80	72	183
26	HRSG Cycle Makeup	28	28	27	28	28	34
27	HRSG Unrecovered Losses	3	3	3	3	3	3
28	HRSG Sampling Losses	5	5	5	5	5	5
29	HRSG Blowdown (before cooling)	20	20	20	21	21	26
30	HRSG Blowdown (after cooling)	48	47	46	48	48	60
31	HRSG Vent Flashing Losses	18	18	18	18	18	23
32	HRSG Blowdown Quench Water	41	40	39	41	41	52
34	Plant Washwater	10	10	10	10	10	10
35	Oil-Water Separator Effluent	11	11	11	11	11	11
36	Cooling Tower Evaporation	788	1091	1229	611	548	1394
37	Cooling Tower Drift	0.3	0.3	0.3	0.3	0.3	0.3
38	Cooling Tower Blowdown	197	272	307	152	137	348
39	Blowdown RO Pre-Filter Waste	10	14	15	8	7	17
40	Blowdown RO Feed	187	259	292	145	130	331
41	Blowdown RO Reject	93	129	146	72	65	165
42	Blowdown RO Permeate	93	129	146	72	65	165
43	Clarified Water	984	1377	1557	754	672	1764
44	Filtered Water	955	1336	1511	731	652	1711
45	Gravity Filter Backwash	39	55	62	30	27	71
46	Clarifier Sludge Blowdown	30	43	48	23	21	55
47	Clarifier Decant	21	30	34	16	15	38
48	Thickener Sludge Blowdown	9	13	14	7	6	16
49	Filter Press Filtrate	7	10	12	6	5	13
50	Filter Cake	1.8	2.6	2.9	1.4	1.2	3.3
51	Clarifier Recycle	68	95	108	52	46	122

Notes		Design Values		
			CTG Evaporative Cooler COC	6
			Micro-Filtration Blowdown	10%
			Clarifier Sludge Blowdown	3%
			Gravity Filter Backwash	4%
			Thickener Sludge Blowdown	30%
			Filter Press Solids	20%
			1st Pass RO Reject (% of Feed)	25%
			2nd Pass RO Reject (% of Feed)	10%
			EDI Reject (10% of Feed Flow)	10%
			Number of HRSG	1
			Number of Evaporative Coolers	1
			Quench Water = HRSG blowdown X factor	2.00
			Unrecovered HRSG Losses (% of HRSG Feed)	10%
			Blowdown Vent Flash Loss (% of HRSG BD)	40%
			Steam requirement	65%
			Circ Water COC	5
			HRSG Blowdown (% of HRSG Steam Outlet Flow)	2%
			Density of water at 87F (lb/gal)	8.3077
			Drift % of Circ Water Flow (gal/min)	0.0005%
			RO Pre-Filter Waste	5%
			Blowdown Sidestream RO Reject (% of Feed)	50%
			Clarifier Sludge (1% of Clarifier Feed)	1%
			Clarifier Liquid (100% - Clarifier Sludge %)	99%
			Filter Press Solids Moisture Content	10%

FIGURE K-3b
WATER BALANCE CALCULATIONS
LODI ENERGY CENTER
LODI, CALIFORNIA

Source: Worley Parsons LTD, LODI-0-DC-510-ME-0002D, 08-20-08

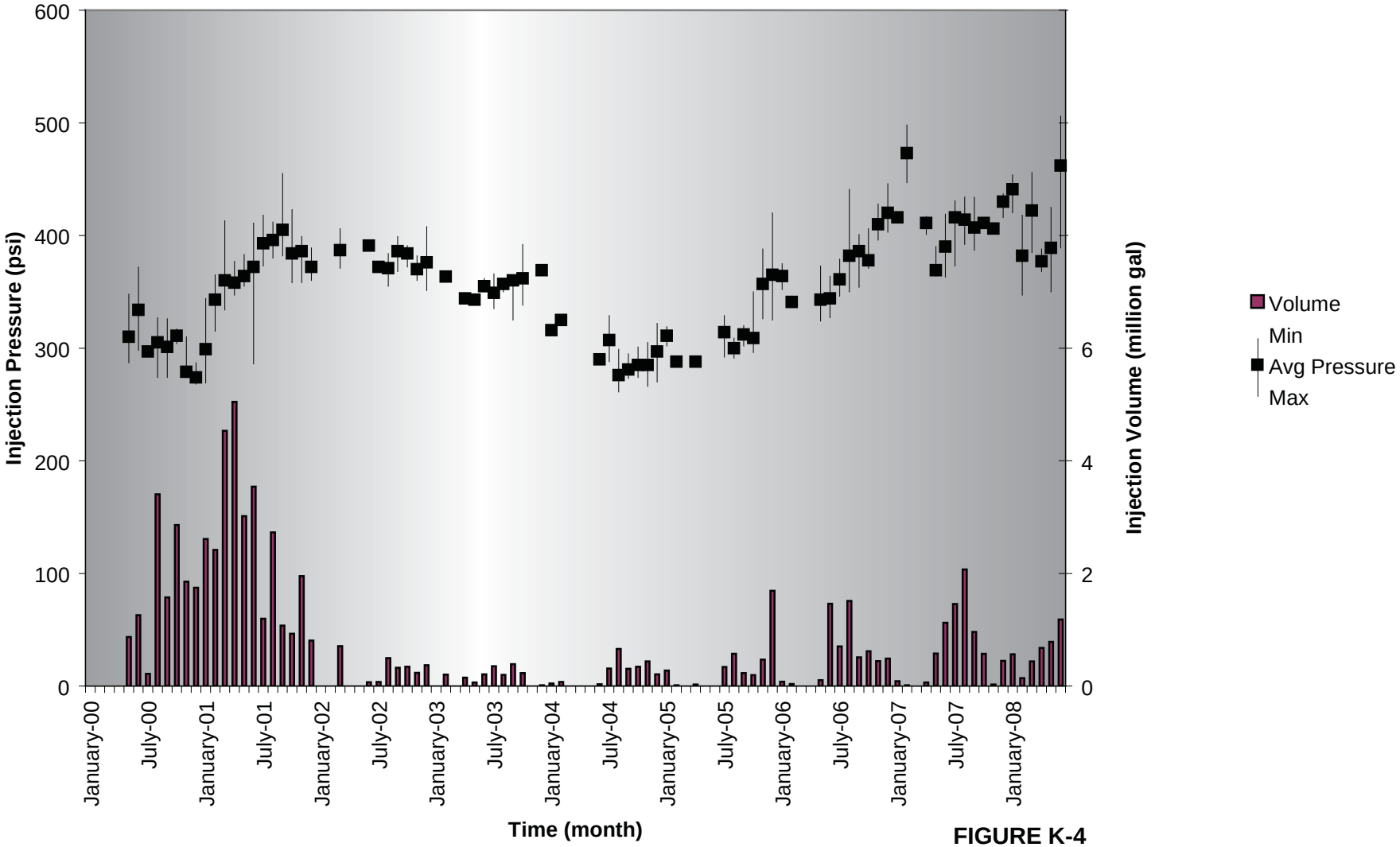

FIGURE K-4
WELLHEAD PRESSURE–ANNULAR PRESSURE VS. INJECTION RATE
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Source:
Northern California Power Agency, 2008

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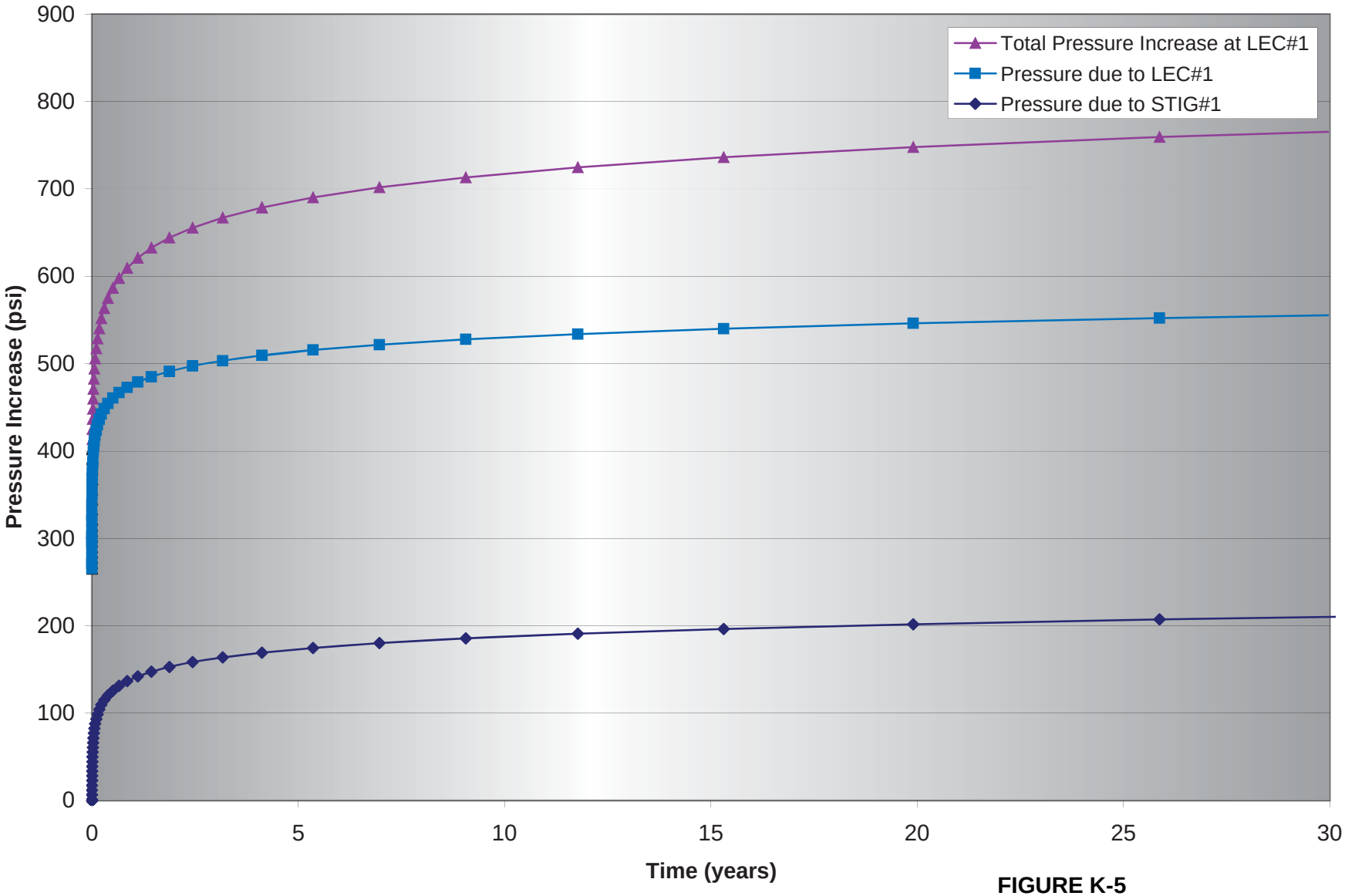


FIGURE K-5
CALCULATED PRESSURE INCREASE AT LEC-1
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Attachment L
Construction Procedures

Application Requirements

Discuss the construction procedures (according to §146.12 for Class I) to be utilized. This should include details of the casing and cementing program; logging procedures; deviation checks; the drilling, testing, and coring program; and proposed annulus fluid. (Request and submission of justifying data must be made to use an alternative to packer for Class I).

Approach

This section will describe the proposed construction procedures for the LEC-1 Class I well and the LEC-2 backup well, if drilled, according to rules in 40 CFR §146.12. This section includes details of the casing and cementing program; logging procedures; deviation checks; the drilling, testing and coring program; and proposed annulus fluid. References to LEC-1 would also apply to LEC-2.

Details of the STIG-1 well construction included in the 1993 permit application are provided in Appendix 10. Existing and estimated well coordinates for the STIG-LEC facility injection wells are shown in Table L-1.

TABLE L-1
STIG-LEC Facility Injection Well Coordinates

LABEL	Longitude	Latitude
STIG-1	-121.388459	38.088426
LEC-1 (estimated)	-121.387604	38.087269
LEC-2 (estimated)	-121.386011	38.087335

Casing and Cementing Program

The well construction for LEC-1 has a lower casing and sand pack installed within the well casing because flowing sands were encountered at the STIG-1 site. The construction utilized at that location effectively addressed the condition. Since the STIG-1 has operated effectively since it was constructed, a similar approach will be used for future well installation at the site.

The LEC-1 well will be constructed using the following casing and cementing program:

- From 0 to 30 feet bgs set 16-inch nominal diameter carbon steel conductor pipe in 18-inch-diameter borehole, and cement in place with Portland type “G” cement.
- From 0 to 610 feet depth, set 10 ¾-inch nominal diameter, 40.5 pounds per foot, American Petroleum Institute (API) grade K-55, short thread couplings (ST&C), casing through conductor pipe and into a 14 3/4 -inch diameter borehole from 30 feet to 610 feet, and cement in place with approximately 395 cubic feet of type “G“ cement. Contractor will make recommendations on specifics of the cementing program at time of construction, including recommending specific additives such as calcium chloride, gel, fly ash, or Field Processing System (FPS) to control cement hydration time, bonding ability, or shrinkage.
- From 0 to 3660 feet depth, set 7-inchnominal diameter, 20 pounds per foot, grade K-55 ST&C casing through 10 ¾-inch casing and into 9-7/8-inch borehole from 610 feet to 3,660 feet, and cement in place with approximately 1,650 cubic feet of type “G” cement with sufficient additives to control hydration, bonding and shrinkage.
- From 3,360 to 4,575 feet depth, set 4-1/2-inch nominal diameter, 15 pounds per foot, grade K-55, ST&C liner through 7-inch casing to 3,660 feet and into 6 ¼ -inch diameter borehole from 3,660 feet to 4,575 feet, and cement with 190 cubic feet type “G” cement.

Logging Procedures

Logs in Surface (7-inch) Casing Interval

A commercial geophysical wireline logging company will be contracted to perform a "Dual Induction Compensated Density Dual Spaced Neutron Log," including Gamma Ray, Caliper, and Spontaneous Potential tracks, throughout the interval between the shoe of the 10 ¾ -inch casing at 610 feet and the bottom of the 9-7/8-inch borehole at 3,660 feet. Copies of the log at scales of 2 inches=100 feet and 5 inches=100 feet will be submitted upon completion of the well construction.

After the 7-inch casing is run and cemented, a Neutron Casing Collar and Cement Bond Log will be run from 3,660 feet to 0 feet. A copy of that log at a scale of 5 inches=100 feet will be submitted upon completion of the well construction.

Logs in Deep (4-1/2-inch) Liner Interval

A "Dual Induction Compensated Density Dual Spaced Neutron Log," including Gamma Ray, Caliper, and Spontaneous Potential tracks, will be run throughout the interval between the shoe of the 7-inch casing at 3,660 feet and the bottom of the hole at 4,575 feet. Copies of that log at scales of 2 inches=100 feet and 5 inches=100 feet will be submitted upon completion of the well construction.

Completion Logging

Upon completion of the well construction—and as part of the initial injectivity testing of the well, temperature, pressure, and spinner flow meter—logging of the well will be performed

throughout the well depth and repeated through the injection interval. The sequencing and interpretation of these logs is described in greater detail in Attachment I: Formation Testing Program.

Lithologic Logs

A lithologic ("Mud") log will be prepared during the drilling of the LEC-1 well. This log, included, will graphically describe at a scale of 2 inches= 100 feet the lithologic units found within the 30-foot to 4,575-foot interval of the LEC-1 well. The log will be prepared by visually describing the rock cuttings brought to the surface during the drilling operations via the mud circulation system. Since no cores are anticipated to be collected from the borehole, only cuttings and geophysical logs will be used to prepare the lithologic log.

Final Descriptive Log Interpretation Report

A descriptive log interpretation report will be prepared to describe in detail the Domengine Formation interval in the LEC-1 well upon completion of construction. That report will list, for each 2-foot depth interval between the depths of 3,642 feet and 4,575 feet, the calculated shale and sand volumes, water saturation, the porosity values as independently measured by the neutron and density logging tools, the apparent resistivity of the formation water, and provide a cross plot-derived ("best choice") porosity value for each interval.

A compact disk containing the same information at single foot intervals, will be prepared and used to calculate a (NaC1 equivalent) salinity value at each 1-foot depth interval. A listing of those results obtained throughout the proposed 4,230-foot to 4,570-foot completion interval within the Domengine Formation will be included in the submittal at the end of construction.

Deviation Checks

Single shot deviation checks will be made at 10 equidistant or equal spaced depths in the well bore, ranging from 500 feet to 4,575 feet (proposed total depth). Each deviation check will be individually reported, and a maximum allowable deviation from vertical by more than 1 ½ degrees will be allowed. The absolute allowable maximum lateral displacement of the well at total depth will be 100 feet. If there is concern about deviation in the well bore, a gyroscope survey will be run.

Proposed Well Completion

Injection Interval

Since subsurface conditions at the LEC-1 well are anticipated to closely match those at the adjacent STIG #1 well site, it is anticipated that the Domengine Formation sands will be poorly consolidated and flowing at the LEC-1 well. The proposed completion of the LEC-1 well will be nearly identical to that of the STIG #1 well:

- Perforate the injection interval from 4,230 to 4,575 ft bgs using a down-hole perforation gun with 120 degree phasing and resulting in 0.3-inch diameter perforations every 4 inches

- Install 420 feet of 2-15/16-inch outside diameter screened liner inside perforated 4-1/2-inch liner from 4,155 to 4,575 feet, and place 12-20 mesh sand pack material between liner and screen for sand control.

Injection Tubing and Packer

Injection will be through a 4 ½-inch nominal diameter, 10.5 pounds per foot, grade J-55 tubing set inside the 7-inch casing from the surface to a Baker Model AL-2 (or equivalent) Large Bore Lok-Set retrievable packer set at 3,340 ft bgs.

Annular Fluid

After the well is completed, the annular space between the 4 ½-inch diameter injection tubing and the 7-inch casing will be filled with fresh water containing corrosion inhibitor and algaecide.

Attachment M
CONSTRUCTION DETAILS

Application Requirements

Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.

Approach

Figures M-1 and M-2 show the proposed subsurface and well head construction schematics.

Figures

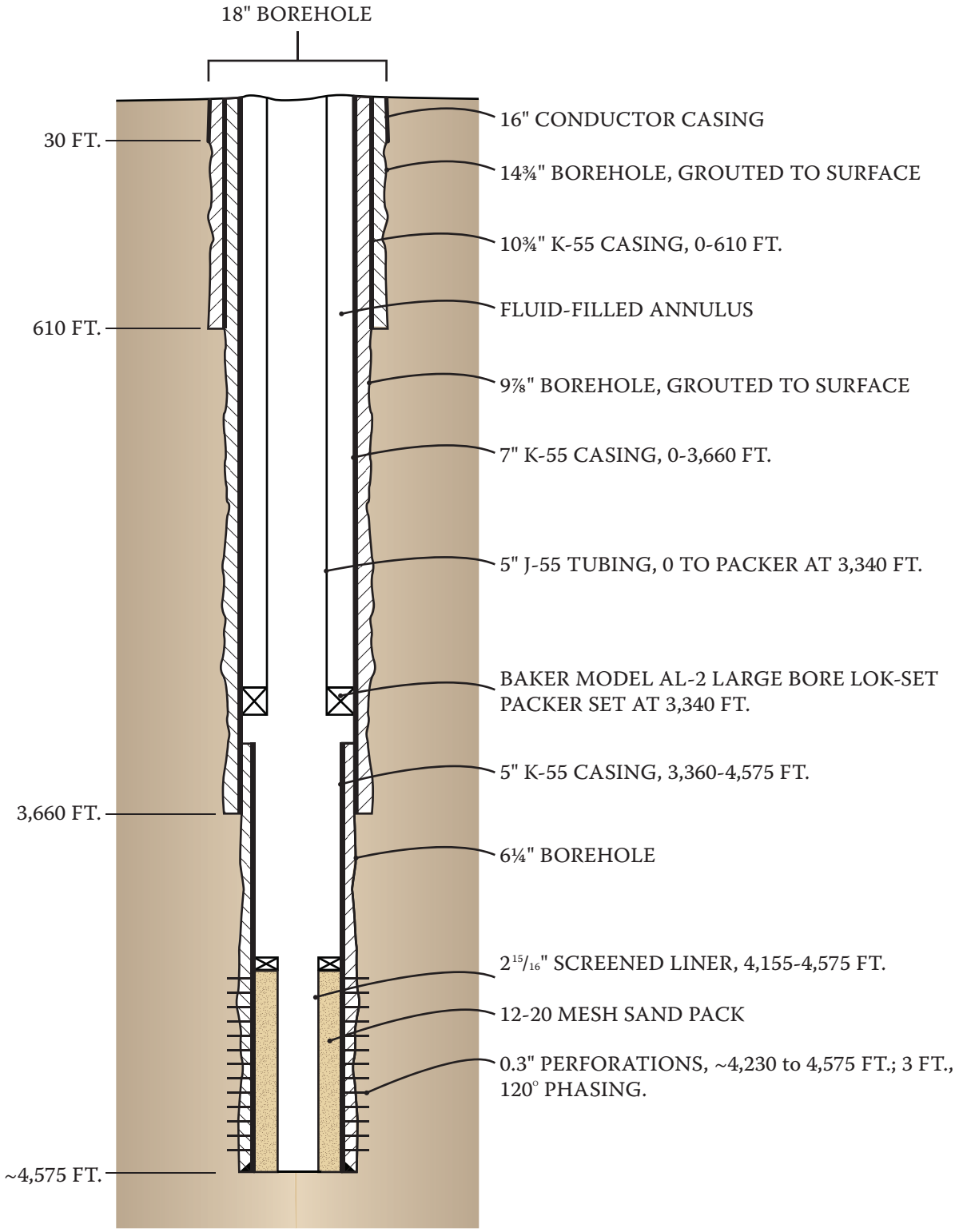


FIGURE M-1
PROPOSED LEC-1 AND LEC-2 WELL CONSTRUCTION
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

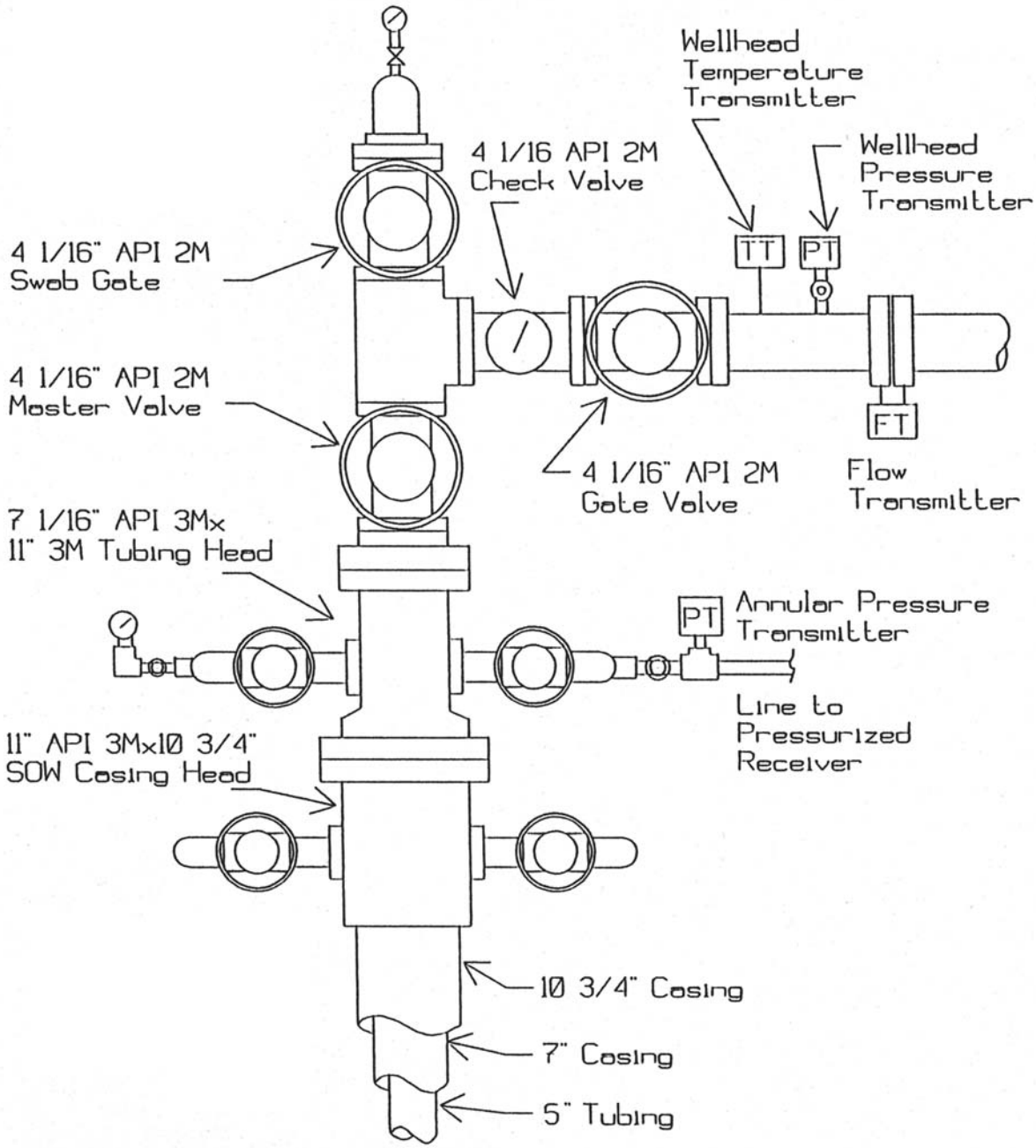


FIGURE M-2
NCPA LODI LEC-1 AND LEC-2
PROPOSED INJECTION
WELLHEAD DESIGN
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Source:
Northern California Power Agency, May 1993

Attachment N
CHANGES IN INJECTED FLUID

Application Requirements

Discuss expected changes in pressure, native fluid displacement, and direction of movement of injection fluid. (Class III wells only.)

Approach

Attachment N is not required for this application.

Attachment O
Plans for Well Failures or Shut-ins

Application Requirements

Outline contingency plans (proposed plans, if any, for Class II) to cope with all shut-ins or wells failures, so as to prevent migration of fluids into any USDW.

Approach

This section presents how interruptions in injection well operation will be addressed overall at the STIG-LEC facility.

Contingency Plan for Well Failures or Shut-ins

Both the STIG and LEC facilities will operate with dedicated injection wells to support waste operation. However, interruptions in well operation can be expected to occur for either short-term or longer periods of time.

Short-term Interruptions

Short-term interruptions could include power outages, minor equipment failure, well-testing, or other conditions that would take a well out of operation for a period of up to a few days. In these situations, existing holding tank capacity and/or injection well capacity will be utilized.

LEC cooling tower blowdown and injection well piping will be configured to supplement the ability to discharge to the existing STIG plant wastewater storage tank or directly to the STIG-1 injection well. Conversely, the STIG Waste Water Discharge Storage Tank and injection pump discharge piping will be modified to supplement the ability to discharge STIG plant wastewater to LEC's injection well.

Supplemental injection well capacity is available to offset a short-term operational or mechanical interruption. LEC-1 and STIG-1 would each 'back up' the other well. The injection rates proposed in this UIC application are above the anticipated need for routine operation of the power plants. It is anticipated that if a short-term interruption occurs, the combination of holding tank capacity and supplemental injection well capacity will enable the plants to operate uninterrupted.

Well maintenance, if needed, and testing is planned to be conducted during winter months when power demands are lower, or when the power plants are undergoing maintenance procedures.

Long-term Interruptions

Long-term interruptions could include well-failure, significant equipment failure, or poor well operation. NCPA has prepared this application to enable installation of a third well, LEC-2, at the STIG-LEC facility if power plant operations are not able to be maintained at appropriate levels. If long-term interruptions occur, short-term procedures will be implemented as long-term solutions are developed. If installation of the third well is initiated, activities would be coordinated with EPA and applicable local and state agencies as they will be for installation of LEC-1.

Attachment P
Monitoring Program

Application Requirements

Discuss the planned monitoring program. This should be thorough, including maps showing the number and location of monitoring wells as appropriate and discussion of monitoring devices, sampling frequency, and parameters measured. If a manifold monitoring program is utilized, pursuant to §146.23(b)(5), describe the program and compare it to individual well monitoring.

The following program of well data acquisition and review is proposed for purposes of prudent well operation, early recognition of any developing problems, and compliance with regulatory agency requirements. These monitoring activities are to include the use of continuously recording devices to monitor the mechanical integrity of the well, and to record the physical conditions occurring at the well head during injection (temperature, pressure, flow rate). In addition, coordinated programs of inspections, samplings and analyses, tests, loggings, and reviews are described below, together with a schedule of the reports to be submitted.

Approach

Each of the various monitoring requirements applies equally to each injection well at the STIG-LEC facility. Therefore, the information in this attachment will be presented by monitoring type and not by individual well.

Mechanical Integrity Monitoring/Reporting Program

Continuously Recording Monitor Devices

The mechanical integrity of the well will be monitored by the use of instrumentation devices that continuously record the annular pressure between the 4-1/2-inch tubing and the 7-inch casing above the packer. The annular space will be kept full with water and pressurized to a minimum of 100 psig with a pressurized receiver located at the wellhead. During each work shift, the water level in the receiver will be recorded by the operator, and the monitoring devices will be inspected and checked to confirm that they continue to operate properly. Daily and monthly minimum, average, and maximum values for these two parameters will be compiled monthly and reported quarterly.

Annual Mechanical Inspection and Evaluation

Each year, a program of mechanical inspection and evaluation will be performed. This consists of both mechanical integrity testing and annular pressure testing. Procedures

implemented during the 2007 testing are included in Appendix 8. The specific steps in this program are summarized below:

- Record a continuous Temperature Log from the surface to total depth while the well is on injection.
- Perform a Pressure Falloff Test by recording pressures immediately prior to and following well shut-in.
- Record a continuous static Temperature Log from total depth to the surface following the Pressure Falloff Test, prior to resuming injection.
- Conduct the annular pressure test
- Analyze the logging and tests results; prepare and submit an Annual Report that includes calculated values of static pressure, transmissivity, and skin factor for the injection zone, an explanation of the probable cause(s) and the recommended remedial action for any significant changes, and an assessment of whether the injected water is indicated to have been confined to the intended injection zone.

Each year, MIT procedures for the annual test will be provided to USEPA prior to conducting the test.

Injection Fluid Monitoring/Reporting Program

Continuously Recording Monitor Devices

Continuous monitoring devices will be installed and used to record the temperature, injection pressure, flow rate, and volume of fluid injected. These devices will also be inspected during each work shift to confirm that they are operating properly. Daily and monthly minimum, average, and maximum values for these four parameters will similarly be compiled monthly and reported quarterly.

Meters and valves will be installed to enable the STIG-1 and LEC-1 wells to act as 'back up wells' to the other. These meters will record the rate at which injection fluid from one system is transferred to and injected by the other. This information will be recorded on a daily basis and included in the quarterly report to EPA. This system has not been designed yet because the plant design will not occur until the California Energy Commission is close to approving the plant permit. Once the system enabling the interconnection between the two systems is designed, the information will be forwarded to the EPA.

Monthly Fluid Sampling and Chemical Analyses

A representative grab sample of the injection fluid will be collected and chemically analyzed each month by an outside organization, using procedures in accordance with standard professional practice. The following parameters will be analyzed:

1. Background Quality Indicators:
   - specific gravity, specific conductance, hardness
   - TDS and pH
   - BOD and COD

- chloroform
- turbidity

2. Inorganics:
   - barium, bicarbonate, calcium, chloride, copper, fluoride, iron, magnesium, nitrate, potassium, silica, sodium, sulfate, zinc.

Quarterly and Annual Fluid Sampling, Chemical Analyses

Prior to initial operations, and once a quarter thereafter, the samples will also be tested for all of the substances and parameters contained in 40 CFR § 261.24 and Title 22 of the California Code of Regulations (CCR) § 66261.24. The testing performed on the samples will follow the procedures listed in either 40 CFR 261 Appendix III or Title 22 of the CCR § 66261.126 Appendix III.

If a constituent is not detected during the first 12 months of injection well operation, future tests for that constituent will be conducted only once a year. Thereafter, if no amounts are reported above the detection limit for four consecutive annual sampling periods, no future tests for that constituent will be conducted.

Fluid Analyses Reports

The results of the monthly and quarterly injection fluid chemical analyses will be compiled and presented, together with a summary of the continuously recorded injection fluid parameters, in a comprehensive report to be submitted quarterly. That report will include a completed EPA Form 7520-8 and, on an annual basis, a completed EPA Form 7520-11.

Groundwater Monitoring Program

No additional groundwater monitoring wells or operations are planned for this program. Existing groundwater monitoring wells surround the STIG-1 site, and they will continue to be monitored as part of the permit conditions for operations at the City of Lodi White Slough Water Pollution Control Facility.

Attachment Q
Plugging and Abandonment Plan

Application Requirements

Submit a plan for plugging and abandonment of the well including: (1) describe the type, number, and placement (including the elevation of the top and bottom) of plugs to be used; (2) describe the type, grade, and quantity of cement to be used; and (3) describe the method to be used to place plugs, including the method used to place the well in a state of static equilibrium prior to placement of the plugs. Also for a Class III well that underlies or is in an exempted aquifer, demonstrate adequate protection of USDWs. Submit this information on EPA Form 7520-14, Plugging and Abandonment Plan.

Approach

The STIG-LEC facility wells will have similar construction, and each will need to be abandoned when they are no longer operable or the power plants are decommissioned. Therefore, the Plugging and Abandonment Plan applies to each onsite well.

Plugging and Abandonment Description

The following well description is of STIG-1 and can be inferred to represent both LEC-1 and LEC-2. This is also shown graphically in Figure Q-1. Depths shown and described are as measured from ground surface.

A 10-3/4-inch casing string has been run and cemented from the surface to 611 feet, a 7-inch casing has been run and cemented from the surface to 3,660 feet, and the 4-1/2-inch liner is hung from 3,358 feet to 4,645 feet. The 5-inch liner was cemented prior to being gun-perforated between 4,234 and 4,573 feet. Inside the 5-inch liner is a gravel-packed 2-3/8-inch wire screen liner, installed between 4,155 and 4,567 feet. Inside the 7-inch casing is a 4-1/2-inch tubing string that extends from the surface to a packer set at 3,342 feet.

The overall approach to the abandonment, or plugging, of the wells is to install a continuous cement plug to 100 feet above the top of the 5-inch liner. A second continuous cement plug is to be installed from a depth of approximately 700 feet, which is approximately 250 feet below the estimated depth of the potable aquifer (3,000 mg/L TDS) at this location to ground surface.

The plugging procedures are as follows:

1. Move in and rig up a workover/completion rig. Remove the wellhead and install and activate blowout prevention equipment (BOPE). Run in the hole and unseat the packer. Pull the 4-1/2-inch tubing string and packer out of the well.

2. Inject sufficient fresh water into the well to displace the wellbore fluids. Contain displaced water.
3. Check the well depth to confirm that the wellbore is open to a depth of at least 100 feet below the 5-inch hanger (approximately 3,460 feet). If not, bail the well to that depth.
4. Run open-ended 2-3/8-inch tubing with 1,200 feet of 1 ¼-inch to RND, EUE, N-80 tubing stinger to at least 3,460 feet, but as deep as possible down to a maximum depth of 4,567 feet. Tremie through the tubing a premium cement plug by coordinating the pumping of cement and gradual withdrawal of tubing until the tubing has been pulled up to a depth of 3,160 feet, which is 200 feet above the liner lap. It is estimated that a 280 cubic foot cement plug will be sufficient to fill the well from 4,567 to 3,160 feet.
5. Allow the cement plug to cure for at least 12 hours, or the manufacturer's recommendation.
6. Tag the top of the cement plug to confirm that it is at least 100 feet above the liner lap. If not, add additional cement and wait an additional 12 hours for it to cure. Repeat this step as necessary.
7. Pull up to a depth of 700 feet. Tremie grout a cement plug to the ground surface. As above, allow the cement plug to cure for at least 12 hours, or the manufacturer's recommendation.
8. Add additional cement and wait an additional 12 hours for it to cure. Repeat this step, as necessary, until the cement plug is within 2 feet of ground surface.
9. Remove the BOPE and move the rig off. Cut off the wellhead and casing at ground level and weld a 3/8-inch steel plate to cap off the 7-inch casing.
10. Restore to grade, with a recommended brass marker installed to identify the former well site.

Cost Estimate

The cost estimate to plug and abandon an injection well at the STIG-LEC facility consists of several components. These include:

- Mobilization—Moving the workover/completion rig to the site and onto the well, and setting up the rig and ancillary equipment.
- Packer and tubing removal and well cleaning—Removing all downhole items from the wellbore; confirming that the hole is open at the perforated interval, and bailing the well to remove sediment if it isn't; and recirculating fluid into the hole to clean it.
- Installation of two cement plugs—Plugs are installed through the injection interval and in the upper potable aquifer zone.
- Site restoration—Removing above-grade equipment, installing steel plate, and conducting site restoration

- Documentation and agency coordination—Coordinating with regulators to notify them if grouting observation is required; and providing written documentation to the appropriate state, federal, and local agencies that the well abandonment was conducted according to the appropriate regulations.

Table Q-1 provides the estimated costs for performing these services if conducted in 2008. A 30 percent contingency is added to the cost estimate to cover unexpected occurrences during the well abandonment. Situations that could increase estimated costs are unexpected downhole conditions, excessive cement curing time, additional cement migrating into the perforated interval, and increasing the amount of cement used or fluid disposal costs. The costs provided in Table Q-1 are expected to increase over time.

Appendix 11 includes the 2005 cost estimate obtained by NCPA from Halliburton for cementing services, including a revised cost estimate. Halliburton's approach is still valid, but it indicated that cement costs have increased by at least 15 percent. Other costs have been obtained from reliable vendors providing these industry services.

Plugging and abandoning each well is estimated to be $104,800. Costs in Table Q-1 are on a per-well basis, assuming each well is done at different times, requiring separate mobilization. Cost savings could be realized if multiple wells are abandoned at the same time.

TABLE Q-1
Estimated 2008 Costs for Plugging and Abandoning STIG-LEC Facility Injection Wells

Item	Quantity	Unit	Unit Price	Cost
Mobilization/Demobilization	1	Lump sum	$15,000	$15,000
Well Preparation	1	Day	$7,500	$7,500
Remove Tubing and Packer	1	Lump sum	$1,000	$1,000
Circulate Fluids	1	Lump sum	$1,000	$1,000
Well Cementing (Rig Time)	1	Day	$7,500	$7,500
Cement Cost – Injection Zone Plug	190	Cubic feet	$75	$14,250
Cement Cost – Surface Plug	190	Cubic feet	$75	$14,250
Site Restoration	1	Lump sum	$5,000	$5,000
			Subtotal	$65,500
Engineering, Documentation	30 percent			$19,650
Contingency	30 percent			$19,650
			Total	**$104,800**

Figures

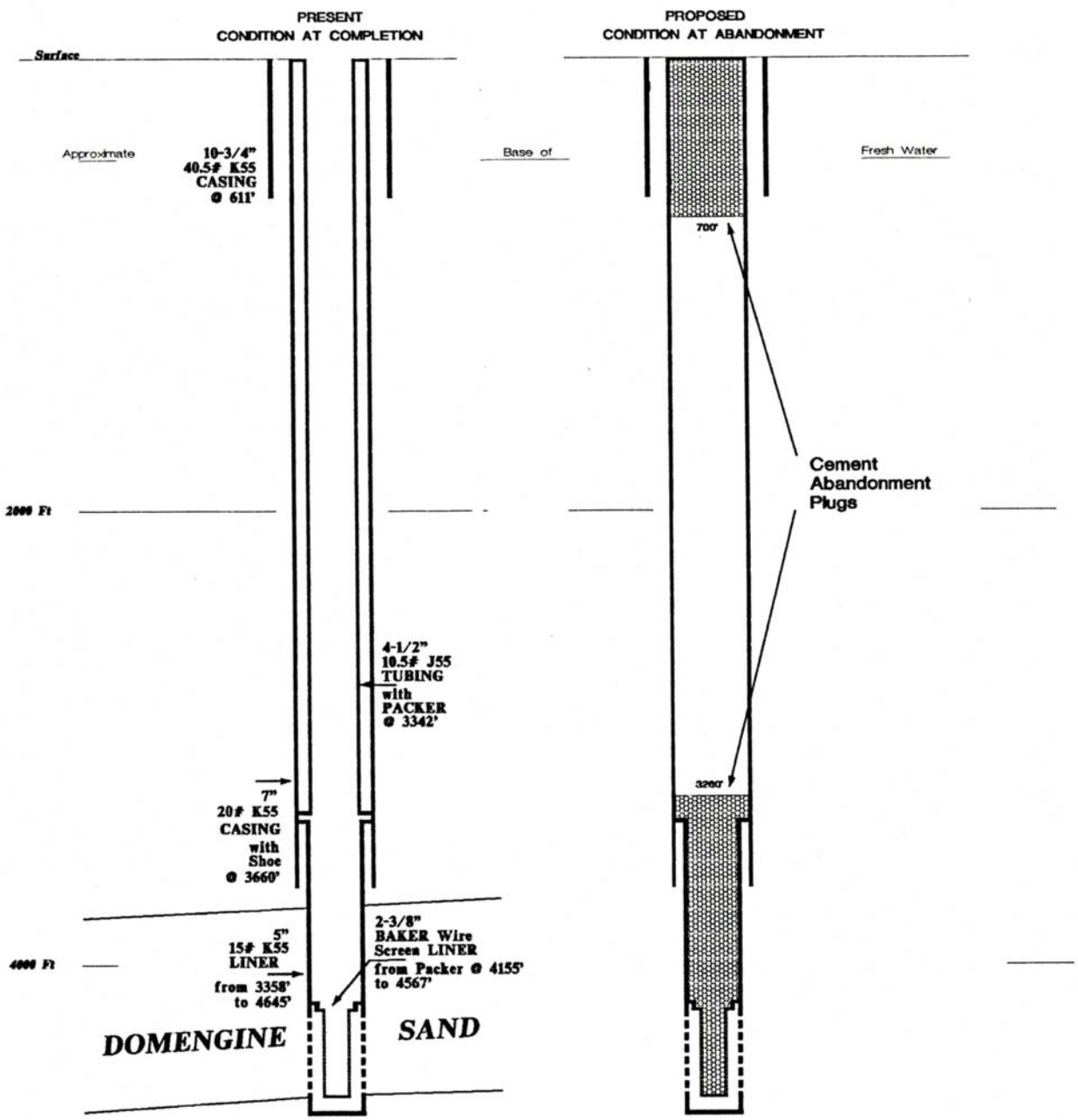


FIGURE Q-1
WELLBORE SCHEMATICS OF THE STIG-LEC FACILITY INJECTION WELLS
STIG AND LODI ENERGY CENTER
UIC PERMIT APPLICATION

Source:
Northern California Power Agency, 1994

Attachment R
Necessary Resources

Application Requirements

Submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.

Financial Assurance Statement

The following letter includes the required form from NCPA's Chief Financial Officer.

A PUBLIC AGENCY
NCPA
NORTHERN CALIFORNIA POWER AGENCY

651 Commerce Drive
Roseville, CA 95678

(916) 781-3636
(916) 781-4255 Fax

www.ncpa.com

October 7, 2008

U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105-3901

To Whom It May Concern:

I am the chief financial officer of the Northern California Power Agency, 651 Commerce Drive, Roseville, California 95678. This letter is in support of this firm's use of the financial test to demonstrate financial assurance, as specified in subpart F of 40 CFR part 144.

1. This firm is the owner or operator of the following injection wells for which financial assurance for plugging and abandonment is demonstrated through the financial test specified in subpart F of 40 CFR part 144. The current plugging and abandonment cost estimate covered by the test is shown for each injection well: $133,600;

STIG-1 (existing), Class I Underground Injection Control Well, located at the West side of White Slough Water Treatment Plant, 12751 North Thornton Road, Lodi, California 95242, located approximately 500 feet north and 0 feet east of the southwest corner of T3N, R5E, section 24 (Mt Diablo baseline).

LEC-1 (proposed), Class I Underground Injection Control Well, located at the West side of White Slough Water Treatment Plant, 12751 North Thornton Road, Lodi, California 95242, located approximately 200 feet north and 400 feet east of the southwest corner of T3N, R5E, section 24 (Mt Diablo baseline).

LEC-2 (proposed), Class I Underground Injection Control Well, located at the West side of White Slough Water Treatment Plant, 12751 North Thornton Road, Lodi, California 95242, located approximately 300 feet north and 800 feet east of the southwest corner of T3N, R5E, section 24 (Mt Diablo baseline).

2. This firm guarantees, through the corporate guarantee specified in subpart F of 40 CFR part 144, the plugging and abandonment of the following injection wells owned or operated by subsidiaries of this firm. The current cost estimate for plugging and abandonment so guaranteed is shown for each injection well: ..... NONE

3. In States where EPA is not administering the financial requirements of subpart F of 40 CFR part 144, this firm, as owner or operator or guarantor, is demonstrating financial assurance for the plugging and abandonment of the following injection wells through the use of a test equivalent or substantially equivalent to the financial test specified in subpart F of 40 CFR part 144. The current plugging and abandonment cost estimate covered by such a test is shown for each injection well: ..... NONE

4. This firm is the owner or operator of the following injection wells for which financial assurance for plugging and abandonment is not demonstrated either to EPA or a State through the financial test or any other financial assurance mechanism specified in subpart F of 40 CFR part 144 or equivalent or substantially equivalent State mechanisms. The current plugging and abandonment cost estimate not covered by such financial assurance is shown for each injection well: ..... NONE

This firm is not required to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on June 30. The figures for the following items marked with an asterisk are derived from this firm's independently audited, year-end financial statements for the latest completed fiscal year, ended June 30, 2008.

ALTERNATIVE II

1. (a) Current plugging and abandonment cost $400,800

   (b) Sum of the company's financial responsibilities under 40 CFR Parts 264 and 265, Subpart H, currently met using the financial test or corporate guarantee .....

   (c) Total of lines a and b $400,800

2. Current bond rating of most recent issuance of this firm and name of rating service ..... Fitch "A"

3. Date of issuance of bond.....July 2008

4. Date of maturity of bond.....2024

5. Tangible net worth (if any portion of the plugging and abandonment cost estimate is included in "total liabilities" on your firm's financial statements, you may add the amount of that portion to this line) ..... $24,796,000*(A)

6. Total assets in U.S. (required only if less than 90% of firm's assets are located in U.S.) .....N/A

7. Is line 5 at least $10 million? .....YES

8. Is line 5 at least 6 times line 1 (c)? .....YES

9. Are at least 90% of the firm's assets located in the U.S.? If not, complete line 10.....YES

10. Is line 6 at least 6 times line 1(c)? .....N/A

I hereby certify that the wording of this letter is identical to the wording specified in 40 CFR 144.70(f) as such regulations were constituted on the date shown immediately below.

Sincerely,

Donna Stevener

Donna Stevener

Chief Financial Officer

Date Signed: October 7, 2008

*(A) The Agency is a State of California joint action public entity that operates on a not-for-profit basis; audit in process.

Attachment S
AQUIFER EXEMPTIONS

Application Requirements

If an aquifer exemption is requested, submit data necessary to demonstrate that the aquifer meets the following criteria: (1) does not serve as a source of drinking water; (2) cannot now and will not in the future serve as a source of drinking water; and (3) the TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and is not reasonably expected to supply a public water system. Data to demonstrate that the aquifer is expected to be mineral or hydrocarbon production, such as general description of the mining zone, analysis of the amenability of the mining zone to the proposed method, and time table for proposed development must also be included. For additional information on aquifer exemptions, see 40 CFR Sections 144.7 and 146.04.

Approach

An aquifer exemption is not requested as part of the permit application.

Attachment T
Existing EPA Permits

Application Requirements

List program and permit number of any existing EPA permits, for example, NPDES, PSD, RCRA, etc.

Permits

An Underground Injection Control (UIC) Permit (Permit No. CA194000002) was issued by the EPA on October 18, 1994 to NCPA STIG Combustion Turbine Project #2 at 12751 North Thornton Road in Lodi, CA 95242-1478. This permit is the existing regulatory permit issued by USEPA and determines the current operation, monitoring, and reporting of the STIG-1 well. A copy of the permit is included as Appendix 1. No other existing EPA permits applicable to the STIG well have been identified.

Several existing air permits not issued by the EPA exist for the STIG facility. These may or may not pertain to this UIC permit application. These are included in Appendix 12, and are:

- San Joaquin Valley Air Pollution Control District, Authority to Construct. Permit Number N-2697-1-3, February 22, 2007. Covers installation of a General Electric LM5000 Natural Gas Fired Turbine Engine.
- San Joaquin Valley Air Pollution Control District, Facility-Wide Permit to Operate. Permit Number N-2697-0-2, expires May 31, 2009. Facility-Wide and Permit Unit requirements for operation of the STIG facility.

Several non-EPA permits will need to be obtained during the drilling, construction, testing, and destruction of the well. These include:

- Notice of Intention to Drill new well issued by DOGGR (Appendix 13)
- Well Permit issued by San Joaquin County Environmental Health Department (Appendix 13)
- Well completion report to be filed with the Department of Water Resources within 60 days from the date of construction, alternation, abandonment, or destruction of a well is completed.

These applications will be completed and submitted to the appropriate agencies when scheduling and planning for LEC-1 well installation is known. These permits have a limited duration and so completion and submittal at this time would not meet the schedule currently envisioned for LEC-1 installation. Once the well permit applications for LEC-1 is completed, and if LEC-2 is installed at a future date, EPA will be notified and copied.

Attachment U
Description of Business

Application Requirements

Give a brief description of the nature of the business.

Approach

The 2006/2007 annual report is enclosed to provide background about NCPA.

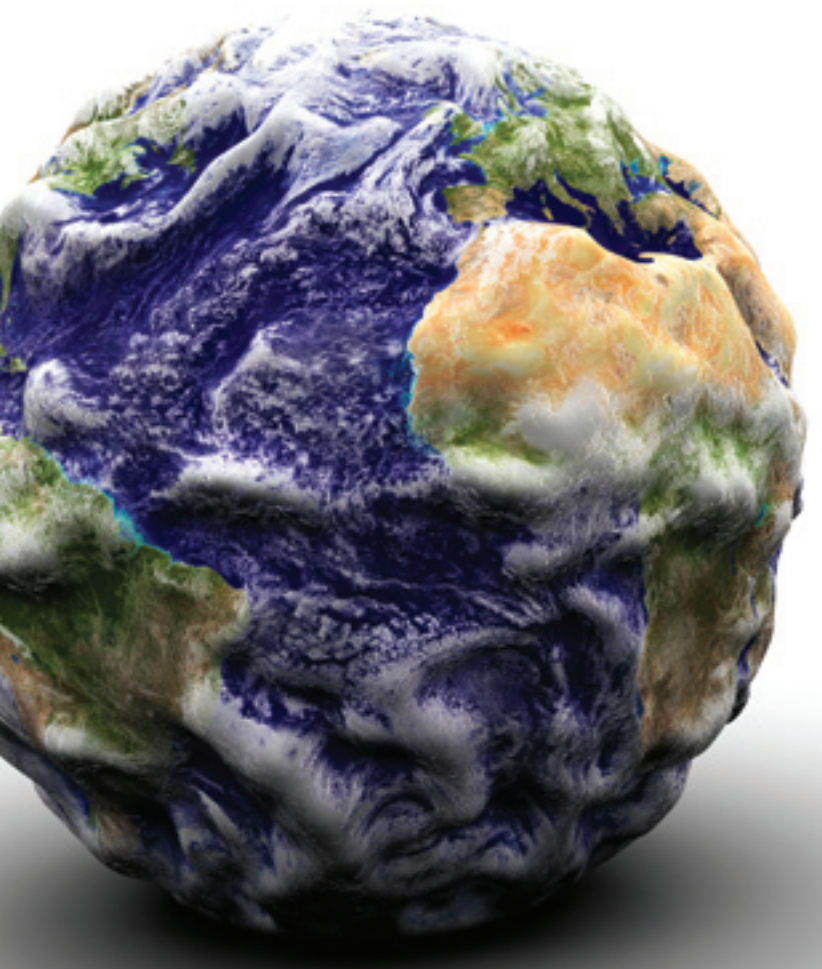
ANNUAL REPORT

2006 | 2007

ENVIRONMENTAL STEWARDSHIP

NORTHERN CALIFORNIA POWER AGENCY

What is the use
of a fine house
if you haven't got
a tolerable planet
to put it on?



WE ARE LEADING THE WAY IN ENVIRONMENTAL STEWARDSHIP.

A REPORT FROM MANAGEMENT. The past year has been marked by significant challenges, important opportunities and remarkable accomplishments for NCPA. As we look to the future with regard to environmental responsibility and meeting the needs of our members' customers, NCPA continues to demonstrate vision, leadership and accountability that has been the hallmark of our successes and paves the way for the future.

Working through joint action we continue to lead the way in environmental stewardship. We are making new investments in clean renewable resources to complement our already 96% carbon free generation portfolio. We have begun plans for a new state-of- the-art clean, natural gas energy plant to be built near Lodi, California. While exploring renewable opportunities, this will help meet our growing demands, promote reliability and ensure price stability for NCPA project owners while employing the latest environmental technologies.

NCPA member utilities have been making vital energy efficiency gains by promoting solar energy. We are leading the way with our overall renewable portfolio of 67% and growing. NCPA's Commissioners have had a long record of environmental stewardship and we continue to set the bar high for the future. We have worked with State Leaders to ensure that California is the first to shape policies to manage Climate Change.

We have operated our generation facilities with remarkable safety records and thanks to the hard work of the men and women who operate our plants we are approaching one full year without any on the job injuries, one of the best records in the industry.

Additionally, our generating facilities are among the most reliable in California. Our Geothermal plant operates at 99% availability.

This year, NCPA was recognized by rating agencies for its stability and proactive management which led to firming of our credit rating from Standard and Poor's and Fitch ratings. Also, we have worked to recover $2.4 Million through the successful resolution of settlement disputes with the California Independent Systems Operator.

This has been a year of success and accomplishment. All we do to meet the demands of today's electricity industry and the needs of our project owners is guided by one central purpose, serving the customer. Every day we work to ensure that

our member/owners receive reliable, affordable and clean energy that is vital to the success of their communities.

Certainly, 2008 will bring new opportunities, challenges. We are confident that through joint action we will achieve even greater accomplishments and deliver sustainable value.

James H. Pope, NCPA General Mananger
Patrick Kolstad, 07-08 NCPA Chairman, City of Santa Clara

CITY OF UKIAH | HYDROELECTRIC GENERATION

IT'S THE LITTLE THINGS THAT COUNT The broad definition of NCPA's mission is to build and operate power plants, purchase power, coordinate and manage wholesale power, and provide legislative and regulatory representation for its members – in short, to provide service. Not included in this broad definition are the many little extras that NCPA continuously provides that truly exemplify NCPA's commitment to member service.

The City of Ukiah's Lake Mendocino Hydroelectric Power Plant is a prime case study for NCPA's service commitment. Ukiah constructed a 3.5 megawatt (MW) hydroelectric plant at the base of Coyote Dam on Lake Mendocino in 1986. The plant had a problematic operating history for the next 12 years until, in 1998, it was forced to cease operations altogether due to changes in Russian River flow requirements. These changes resulted from steelhead trout and Chinook salmon being placed on the endangered species list. While plant operations were discontinued, $2.2 million annual debt service payments continued, creating a tremendous fiscal burden for the City.

In 2005, the City requested assistance from NCPA to help implement design modifications and necessary equipment refurbishment to allow the plant to resume operation. NCPA's Generation Services team procured the required regulatory approvals, preliminary design estimates and budgetary quotes to accomplish the refurbishment project. The Power Management team evaluated the economics of the project.

Generation Services managed the engineering and refurbishment contracts for the project, which included:

- Redesign and construction of the Tainter diversion valve
- Overhaul and testing of the turbine generators
- Upgrades to the protective relays
- Upgrades to the supervisory control system
- Upgrades to the water supply equipment for the adjacent Department of Fish and Game steelhead trout hatchery

Remote operation of the generator and river flow control and power scheduling functions were shifted to the NCPA Dispatch Center.

In April of 2007 the plant was re-commissioned and began producing valuable, clean, renewable energy for the first time in nearly 10 years. The plant will produce approximately 15,000 megawatt hours annually, more than 10% of the City's annual energy use. The renewable energy generated reduces the City's market power purchases, thereby reducing the City's carbon footprint. The resulting savings can be used to pay a significant portion of the project's annual debt service. Improved water supply reliability to the adjacent hatchery helps ensure that the endangered steelhead continue to thrive in the Russian River.

It's not what you look at that matters, it's what you see.

NCPA is proud to have been able to help the City of Ukiah achieve its goals for the Lake Mendocino Hydroelectric Power Plant. This project serves as a reminder that little efforts add up to big successes.

REDDING ELECTRIC UTILITY | THERMAL ENERGY STORAGE

REDDING SHIFTS PEAK AC DEMAND…WITH ICE
Redding Electric Utility (REU) embarked on a pilot program designed to shift peak demand, improve its utility's load factor, and reduce overall energy costs for customers. By developing thermal energy storage (TES) systems with commercial, direct expansion air conditioners (DX/AC), REU has the potential to shift AC-driven load from on-peak to off-peak hours.

DX-based TES systems use the AC compressor to make ice during the off-peak hours. During the utility-defined, on-peak period, the DX/AC systems' refigerant is passed through a coil in the ice using the temperature differential to condense the refrigerant—rather than using the compressor to condense the refrigerant. These systems will typically reduce peak demand consumption by more than 90% and lower total energy use by 10% or more.

REU currently has seven TES demonstration/pilot projects in operation throughout our service territory:

Things do not change; we change.

THE FIRST TES PROJECT WAS A RETROFIT AT THE REDDING MUNICIPAL AIRPORT. The system was designed to completely turn off the 90-ton chiller during the peak afternoon hours and rely solely on the melting ice in the three storage tanks. Reportedly, the building has a more stable, comfortable temperature level with the addition of the TES system.

REU INSTALLED TES UNITS AT TWO FIRE STATIONS. Overall, the peak demand reduction at each station was 95%, with an energy savings of 18%, improved temperature balance and no compromise in occupant comfort.

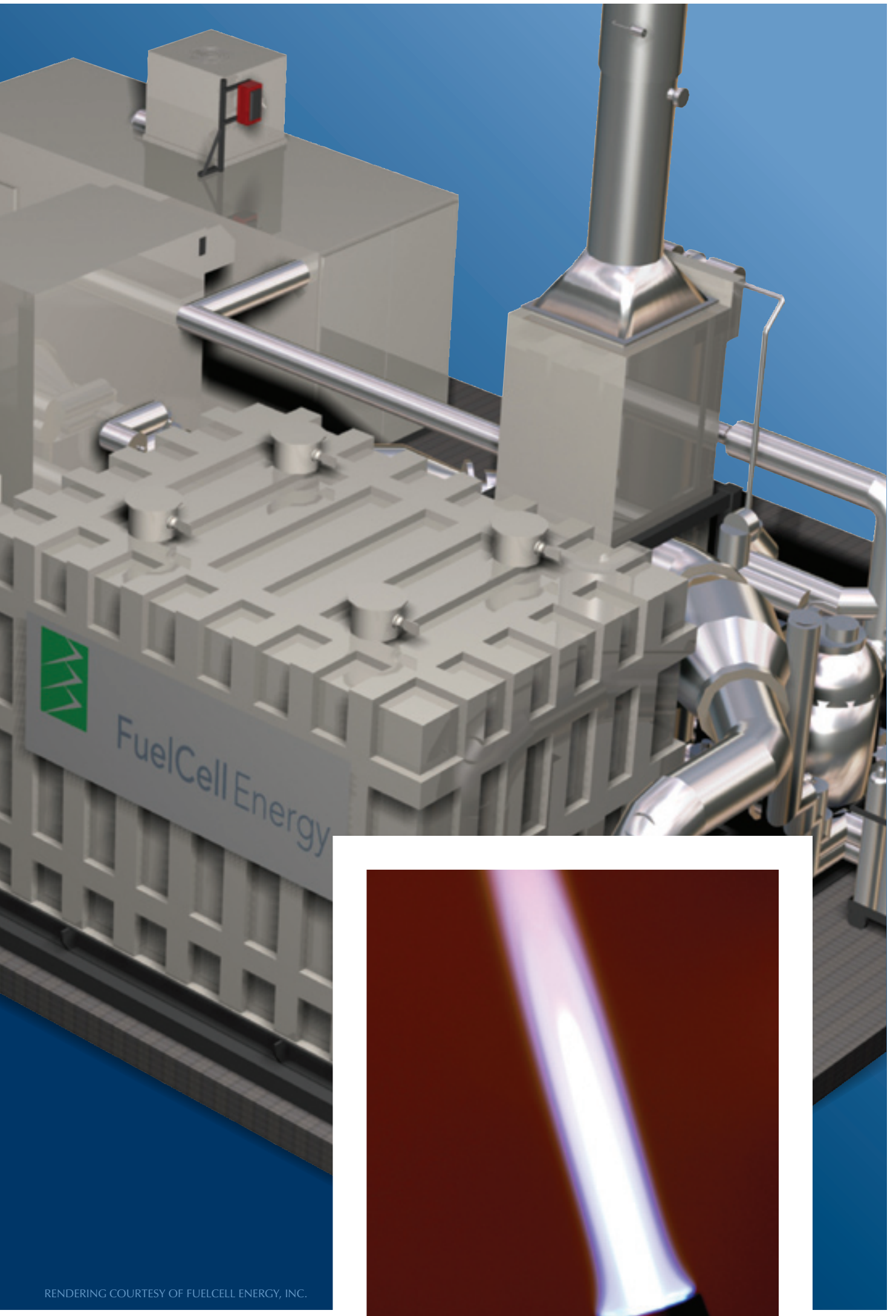
REU HAS INSTALLED TEST UNITS AT TWO RESIDENCES. The first is Habitat for Humanity's new Clover Creek Preserve Caretaker's Cottage. A donated ranch house was moved to the Clover Creek Preserve and completely remodeled to meet REU's Earth Advantage green building program standards. The cottage includes a 3 kW solar photovoltaic system, a 3-ton TES system, and many other energy efficiency improvements. According to REU, the system has shifted approximately 3 kW of on-peak demand to off-peak hours.

IN AUGUST OF 2006 A RESIDENTIAL PROTOTYPE WAS INSTALLED AT THE HOME OF REU DIRECTOR JIM FEIDER. The system has provided excellent cooling and peak-shifting performance: 4.6 kW of demand is reduced to 300 watts during peak hours. The prototype used in this demonstration project confirmed TES performance in a residential deployment. A new size and shape model is under development that will easily integrate with new and existing homes.

THE REDDING COMMUNITY'S LONG AWAITED NEW LIBRARY (55,000 SQ FT) OPENED IN MARCH OF 2007. A TES unit is used to supplement the 110-ton chiller operation during afternoon peak periods (sometimes referred to as partial peak shift). This combination of equipment is projected to reduce kW demand by nearly 200 kW, or 40% compared to a non-TES, refrigerant-based air conditioning system.

The City of Redding has also partnered with the developer of a new 75,000 sq ft commercial office building to incorporate a TES system similar to the library's, but with a larger 170-ton chiller and 6 ice storage tanks.

Based on the positive results of TES installations to date, REU will continue to monitor the TES system as a potential complement to REU's resource portfolio. Redding Electric Utility believes the Redding market is an ideal candidate for small commercial and residential installations and that TES programs will become a vital part of its resource mix in years ahead.



RENDERING COURTESY OF FUELCELL ENERGY, INC.

TURLOCK IRRIGATION DISTRICT | FUEL CELL TECHNOLOGY

INNOVATION GOES GREEN. The Turlock Irrigation District (TID) is leaving no stone unturned in its quest to expand its power portfolio by adding non-polluting renewable energy resources when and wherever possible.

One of the District's latest endeavors is partnering with the City of Turlock to use gas created by the city's wastewater treatment plant digester to produce electricity with the addition of a 1.2 -megawatt fuel cell. Construction of the fuel cell is scheduled for early next summer, with completion and commercial operation anticipated later in the summer.

Fuel cells convert renewable digester gas into electricity electrochemically rather than through a combustion process. They operate hundreds of times cleaner than conventional power generators and virtually eliminate emissions of nitrogen oxides, particulates and sulfur dioxides.

Pending completion of the fuel cell, much of the digester gas produced by Turlock's wastewater treatment plant is being used to operate three boilers that provide hot water used in the treatment process. Excess gas is allowed to flare off.

Both TID and the City believe the plant conversion is an excellent way to benefit their respective customer bases, as well as the environment overall. TID will secure a new source of base-load green power, while the City benefits from reducing air emissions and utilizing a valuable byproduct of its wastewater treatment plant operations.

TID's 100,000 homes, farms, businesses, industries and municipal accounts are located within a 622-square-mile electric service area embracing southern Stanislaus and northern Merced counties and small portions of Tuolumne and Mariposa counties. The District will own and maintain the fuel cell and sell the energy it creates to the City for use at the wastewater treatment plant at a rate based on TID's municipal rate. TID will pay the City of Turlock $.005 per kilowatt-hour for the digester gas it supplies.

Adding a fuel cell to the TID power resource portfolio furthers the District's objective of securing at least 20% of it's energy from non-polluting renewable resources by 2017. The District's existing inventory of renewable generation assets includes small hydro plants on the Tuolumne River and its irrigation canal system, as well as part ownership of NCPA's two geothermal plants in Northern California.

Men hit only what they aim at. Therefore, they had better aim high.

PORT OF OAKLAND

AN INNOVATIVE PARTNERSHIP. The Port of Oakland has created an innovative public/private partnership with SunEdison LLC to finance, build and operate a solar power system at the Port's Oakland International Airport. The Port will purchase the facility's power for 20 years. The solar system nameplate output is 747 kilowatts and it is expected to produce approximately 1 million kilowatt-hours of energy annually. This photovoltaic system will reduce greenhouse gas emissions by an estimated 28 million pounds over 20 years. It will also provide local generation capability for the Port which reduces the load on the already stressed electrical transmission system. The electricity from this clean, renewable energy system will be distributed by the Port's utility system for use throughout the airport.

ROSEVILLE ELECTRIC UTILITY

THE GREENING OF A COMMUNITY. Roseville Electric and Environmental Utilities unveiled a unique, state-of-the-art center designed to educate children and adults on steps they can take to lighten their carbon footprints on the earth. Located in a LEED-certified building, the Roseville Utility Exploration Center offers high-tech, hands-on exhibits on a variety of topics ranging from electricity and solar technology to water conservation, reducing solid waste and storm water pollution.

"An important component to reaching our greenhouse gas reduction goals is to educate Roseville Electric rate payers on ways to reduce energy consumption. Through our partnership with the City's water, sewer and garbage department, we provide our customers, and their children, with a one-of-a-kind facility to learn about our energy efficiency rebates and programs, renewable energy options and new lighting technologies that when embraced by consumers brings us all closer to living a greener, sustainable lifestyle," said Roseville Electric Utility Director Tom Habashi.

The Roseville Utility Exploration Center has five exhibits including a "situation wall" that explains the current state of our environment and a "green house" where visitors will see how lighting, windows, sunscreens, Energy-Star rated appliances and solar technology can work in their everyday lives.

TRUCKEE DONNER PUBLIC UTILITY DISTRICT

WIRE TO WATER PROGRAM. In 1998 the District launched a Wire to Water efficiency program in order to ensure that its wells and pumping facilities were using the most efficient methods to move water. At that time it was determined that many of the water pumping and well facilities were energy inefficient. As part of the maintenance and energy conservation program, the water department's existing facilities were retrofitted to a higher energy efficient system. In addition, new and existing facilities requiring an upgrade for additional capacity are now constructed to the highest energy efficiency standard available.

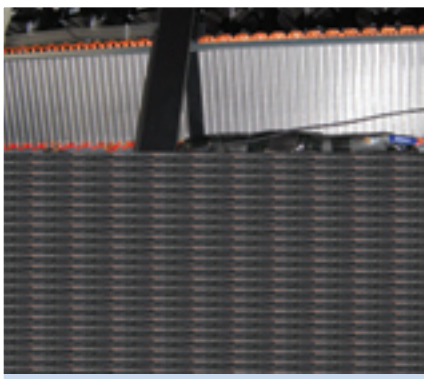
A comparison of the 2001 and 2006 energy cost per million gallons (MG) of water produced shows a savings of $95.43 per MG. The 2006 production of water equaled 2,373 MG. This represents a cost saving of $226,455 and a total energy saving of 2,130,954 kWh, or 22%.

SILICON VALLEY POWER

ACHIEVING ENERGY EFFICIENCY. Silicon Valley Power, the City of Santa Clara's municipal electric utility, recently awarded Sun Microsystems, Inc., with an Energy Innovator Incentive of $250,000 for implementing new energy technologies and for sharing the ideas with other companies in the region. Sun, which provides network computing infrastructure solutions, is the first company to receive the incentive.

Through its pioneering partnership with Silicon Valley Power, Sun has received more than $1 million in rebates and awards for the technology company's cutting-edge data center cooling system, motors and lighting. That equates to a total savings of nearly 4.5 million kilowatt-hours.

In addition, when Sun consolidated its Sunnyvale and Newark facilities into its energy-efficient Santa Clara location, the company reduced its total power consumption by more than 60 percent. As a municipal electric utility, Silicon Valley Power is able to provide its customers with low-cost, reliable energy and share the benefits with Sun and other large and small commercial businesses.



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GENERATION SERVICES

THE POWER TO MEET ANY DEMAND California's power consumption demands require three types of electricity generation: base load generation to supply electricity 24/7, intermediate generation that can follow customer loads throughout the day, and peaking and backup generation for extremely high loads/ problems with the electrical grid. NCPA provides all three types of generation.

The vast majority of energy we produce is from renewable/non-greenhouse gas-emitting sources. We are constantly working to find new ways to meet member needs while increasing renewable energy production and reducing greenhouse gas (GHG) emissions. Some examples of our industry-leading projects:

GEOTHERMAL PROJECT NUMBERS 1 AND 2 These four geothermal power plants help our members meet renewable energy standards established by their local governing boards. The plants harness the energy of The Geysers' steamfield to produce carbon-free electricity for our member communities and districts.

CALAVERAS HYDRO PROJECT NCPA's five hydro generation power plants are used as an intermediate load following resource, adjusting energy production to match our members' loads and contributing to statewide reliability. Hydro generation delivers this service at a lower cost than any other generation resource, with virtually no greenhouse gas emissions. The Hydro Project provides the excess load following and spinning reserves to the California Information Systems Operator (CAISO), providing stateside reliabiliity.

COMBUSTION TURBINE PROJECT NUMBER 1 These units provide capacity that can be called upon to handle extremely high peak loads or emergencies with California's electrical transmission system. The real measure of their performance is the availability to operate when called upon. For the fiscal year 2006/07, the availability was 95%.

COMBUSTION TURBINE PROJECT NUMBER 2 This unit is ideally matched to our members' needs to meet summer peak loads. For 2006/07, the availability of this power plant was 93%.

GREEN POWER POOL PROJECT In 2006 NCPA initiated the Green Power Pool project to help our members meet their renewable energy targets and provide an invaluable source of non-greenhouse gas emission energy. NCPA issued a request for proposals for 50 megawatts of renewable non-GHG sources of energy. Negotiations with potential developers are underway.

LODI COMBINED CYCLE PROJECT (LODI ENERGY CENTER) This state-of-the-art combined cycle project, the cleanest and most efficient natural gas power plant available, will produce energy with 30 to 40% less GHG emissions than purchasing the energy from the market, while promoting optimum reliability. The plant is scheduled to become operational in 2012.

POWER MANAGEMENT

UNIFIED ACTION OPTIMIZES RESOURCE SCHEDULING Power Management provides for the day-ahead, hour-ahead, and real-time scheduling and dispatch of NCPA and NCPA member resources to meet our members' loads. To avoid price volatility in California's real-time electricity markets, we continually adjust generation resources to meet changing NCPA Metered Sub-System Aggregation (MSSA) load. This is known as load following.

NCPA is unique in California's electricity markets in that we are the only load following Metered Sub-System within the CAISO. Through load following with our owned resources, matching loads and resources in real-time, Power Management minimizes the need to purchase or sell energy at unknown prices. This greatly reduces our members' exposure to price volatility and keeps rates low for electric consumers.

NCPA resources are scheduled in a variety of markets to derive the maximum value from those resources for our project participant members. For example, generators such as our Cumbustion Turbine Project 1 (CT1) may have an operating cost that would not be cost-effective in a day-by-day market; however, there is benefit to be gained from selling the capacity of those generators to the CAISO in the form of non-spinning reserve. This ancillary service allows NCPA to be paid hourly to have the generators ready to start and capable of being loaded to a certified MW amount within 10 minutes.

Other generators that are cost-effective to operate on an hour-by-hour basis are marketed to allow the CAISO to continually balance its load and generation mix on a second-by-second basis. Generators that are capable of participating in multiple markets are dispatched to capture financial benefits.

NCPA members are also pursuing and have acquired green power generation resources, such as wind and landfill generation. Another role of NCPA Power Management is to schedule these resources to their full capable output. This includes outage coordination for landfill generators, daily schedule true-ups for wind generators, and load adjustments on small hydro resources to accommodate water release requirements.

NCPA Power Management is capable of providing the optimal integration of these green resources into the MSSA portfolio and maintaining high reliability.

ve energy from shared vision;

LEGISLATIVE AND REGULATORY

THE POWER OF PARTNERSHIP. NCPA continues to lead by example, helping achieve state environmental goals in the areas of renewable energy, energy efficiency, and greenhouse gas emission reductions.

NCPA has taken meaningful steps to further our longstanding tradition of social and environmental responsibility by:

- Applying innovative solar technology to operate a pipeline that transfers treated effluent from Lake County to our geothermal steam field at The Geysers, thus prolonging the life of this vital renewable resource.
- Establishing a new Green Pool through which NCPA members can rely on joint action to grow their green energy portfolios on a collective basis.

COMMISSION ACTIVITIES. Environmental responsibility is of critical importance at all levels of government. Through the involvement and vision of our Commission – comprised of proactive and forward-thinking locally elected officials from our member communities – NCPA has been able to partner with state policymakers to promote shared environmental objectives. We have played a key role in formulating state policies that ensure support from the public power community while allowing for key decisions on renewable energy and energy efficiency programs to be made at the local level. These public power programs begin with local support and interest. They are most successful when closely tailored to local community characteristics and needs.

MEMBER SUCCESSES. The diversity of effective approaches employed by our members is clear:

- Increasing the efficiency of air conditioning units has been a successful approach in Redding.
- The Plumas-Sierra Rural Electric Cooperative relies on thermal heat pumps to help reduce the need for winter electric heating.
- In the Turlock Irrigation District, installation of a new fuel cell technology helps offset electrical demands associated with the community's water treatment plant.

Through locally controlled programs, NCPA members have shown time and again they are out in front in achieving and exceeding state environmental targets.

Our long tradition of environmentally responsible energy choices has led to NCPA's 96% carbon-emission-free owned-generation portfolio. But resting on our laurels is not the NCPA way. As we look to meet the future growth needs for our communities, the Agency is focusing on the cleanest energy sources. We are establishing new programs that provide the tools our members need to promote efficiency and continue to lead on renewable energy development. We are proud of our tradition and are confident that our work at NCPA, and within our member communities, is a very big part of the solution to the environmental goals and challenges that our communities, state and nation face today and in the future.

we deliver energy through joi

ADMINISTRATIVE SERVICES

UNIFIED ACTION MAKES THE NUMBERS WORK

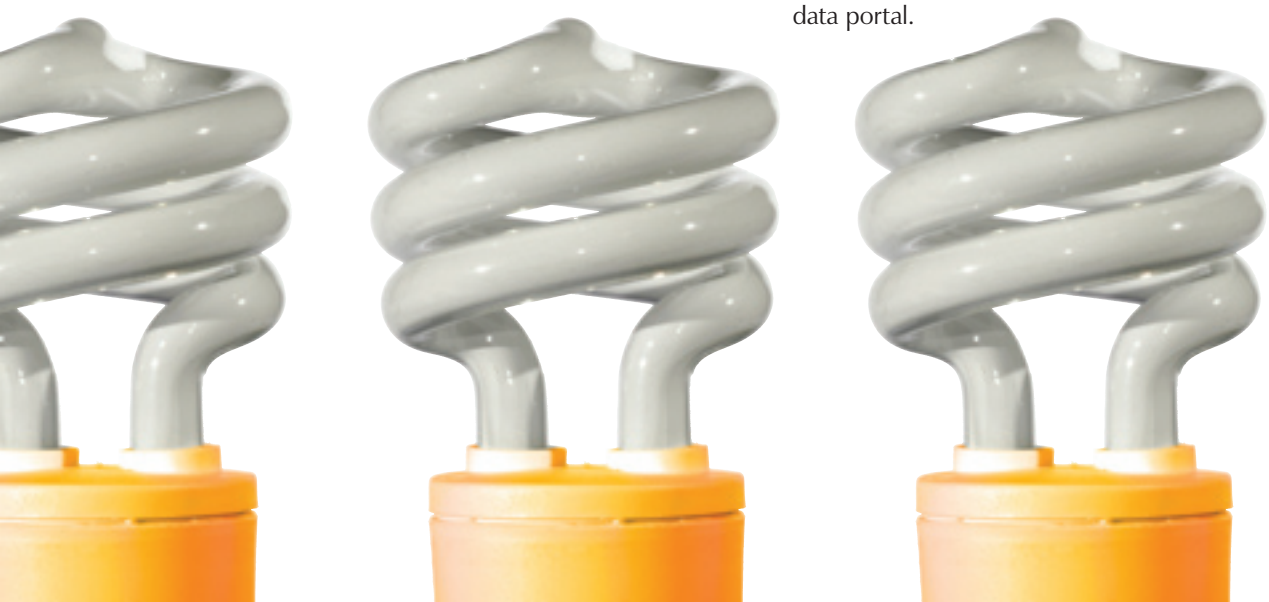
Complex. Webster's definition is "hard to separate, analyze, or solve." This one word describes the work effort of each of NCPA's Administrative Services functions and divisions. And yet, through cooperation and expertise, our Administrative Services team makes untangling the energy market's web of data and charges appear effortless to our members.

In the face of the highly complex CAISO, our Settlements Division works daily to make sense of the 150 CAISO charge types and the 10-minute settlement data we receive from the CAISO.

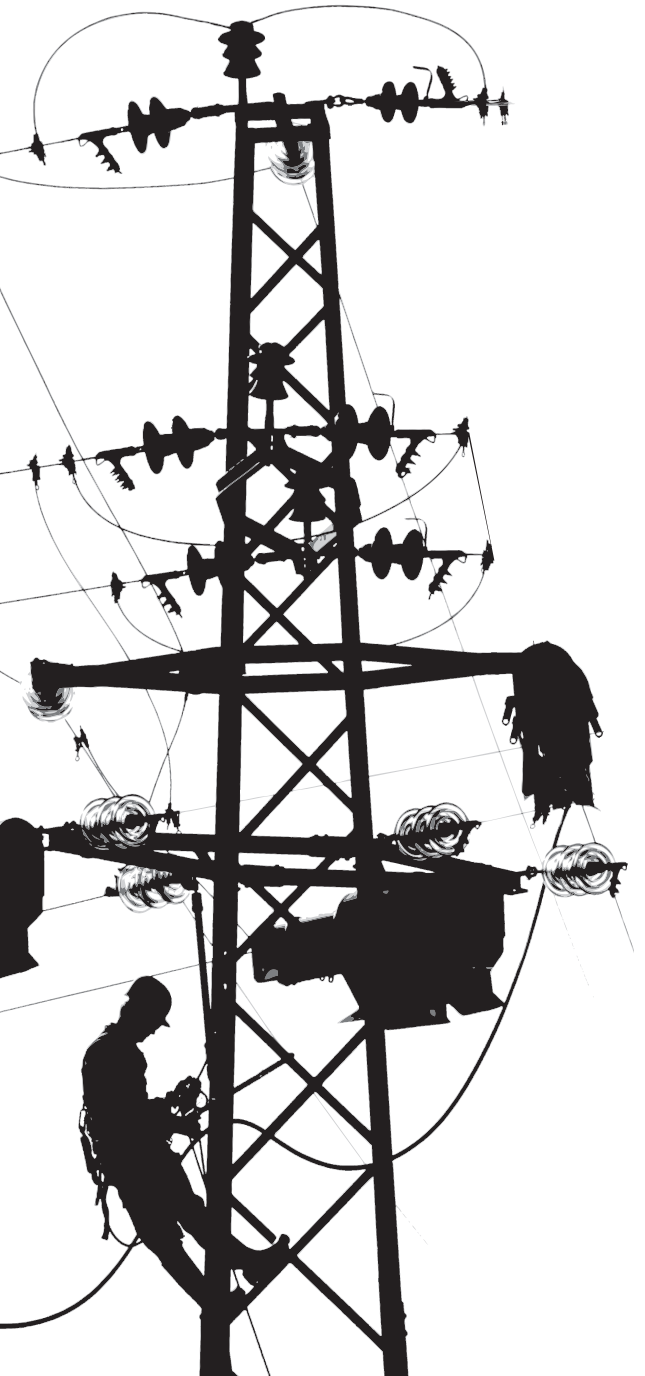
Hourly schedules are prepared on an individual basis, and then aggregated by our Power Management Division and sent to the CAISO. Settlements staff also receives the charge data in this aggregated form. Our job is to make sure the charges are correct and then disaggregate the charges back into separate costs for each individual member. Complicated algorithms assist with this process, and our Information Systems Division is critical in automating this process to increase efficiency and accuracy. Despite this morass of data, our staff dissects, analyzes and consistently recovers miscalculated charges from the CAISO on behalf of our members. This division has also been preparing for the market redesign technology update (MRTU) implementation in 2008.

At this point, the NCPA Accounting staff becomes involved. Accounting's role is to reconcile actual costs to expected budget. Accounting prepares a monthly billing that provides a balance of adequate cash flow for the Agency while minimizing the cash outflow for NCPA members. This billing includes all budget categories—almost 50 different line items, including generating projects, purchased power, CAISO charges and revenues.

Supporting the process, the Information Systems Division provides the underlying calculations for the detailed billing information, along with easy access to this data for our members through our web-based data portal.



energy through joint action.



HUMAN RESOURCES

UNIFIED BY OUR RELATIONSHIPS The relationship we have with our employees is directly linked to the success of the Agency, which includes attracting and retaining talented staff with the needed knowledge, skills and abilities to perform the functions the Agency requires. NCPA is committed to having fulfilling and robust relationships with our entire staff.

The excellent reputation that NCPA has developed within the community and industry is based in part on how we treat employees.

Our personnel policies have been established to provide guidance on NCPA personnel practices and to help build supportive relationships between management and employees.

Over time, the policies and related procedures need to be updated to ensure that employment expectations continue to be clear and to help employees feel secure in understanding their employment relationship.

We have recently updated and revised NCPA personnel policies and procedures to ensure that our actions will continue to:

- Be consistent and fair to employees
- Be understood by all
- Fit with the directions and goals of the Agency
- Be transparent

Through these policies and procedures and consistent application, management is able to create a supportive work environment where employees can contribute, be successful and enjoy their jobs, and NCPA can demonstrate that we care about and value all of our employees.

NORTHERN CALIFORNIA POWER AGENCY MEMBERS

NCPA IN CALIFORNIA

- Members
- Associate Members
- Geothermal Project
- Hydroelectric Project
- CT Project One
- CT Project Two

ALAMEDA POWER AND TELECOM

Commisioner
JOHN MCCAHAN

Utility Director
GIRISH BALACHANDRAN

Population
75,254

Total Energy (GWh)
406.4

Load Mix
00.0% INDUSTRIAL
64.2% COMMERCIAL
35.8% RESIDENTIAL

BAY AREA RAPID TRANSIT

Commisioner
VACANT

Utility Director
FRANK SCHULTZ

Total Energy (GWh)
383.4

Load Mix
100% INDUSTRIAL

CITY OF BIGGS

Commisioner
ROGER FRITH

Utility Director
PETE CARR

Population
1,769

Total Energy (GWh)
17.0

Load Mix
67.3% INDUSTRIAL
08.4% COMMERCIAL
24.3% RESIDENTIAL

CITY OF GRIDLEY

Commisioner
TOM SANFORD

Utility Director
JACK SLOTA

Population
6,167

Total Energy (GWh)
36.6

Load Mix
00.0% INDUSTRIAL
58.8% COMMERCIAL
41.2% RESIDENTIAL

CITY OF HEALDSBURG

Commisioner
GARY PLASS

Utility Director
BILL DUARTE

Population
11,706

Total Energy (GWh)
79.3

Load Mix
39.0% INDUSTRIAL
25.1% COMMERCIAL
35.9% RESIDENTIAL

NORTHERN CALIFORNIA POWER AGENCY MEMBERS

CITY OF LODI

Commisioner
LARRY HANSEN

Utility Director
GEORGE MORROW

Population
63,395

Total Energy (GWh)
476.0

Load Mix
31.3% INDUSTRIAL
35.1% COMMERCIAL
33.6% RESIDENTIAL

CITY OF LOMPOC

Commisioner
MIKE SIMINSKI

Utility Director
RONALD STASSI

Population
42,015

Total Energy (GWh)
144.8

Load Mix
34.3% INDUSTRIAL
21.5% COMMERCIAL
44.2% RESIDENTIAL

CITY OF PALO ALTO

Commisioner
BERN BEECHAM

Utility Director
VALERIE FONG

Population
62,615

Total Energy (GWh)
1,015.4

Load Mix
32.1% INDUSTRIAL
51.1% COMMERCIAL
16.8% RESIDENTIAL

PLUMAS-SIERRA RURAL ELECTRIC COOPERATIVE

Commisioner
TONY MARTINEZ

Utility Director
BOB MARSHALL

Population
17,309 (estimated service area)

Total Energy (GWh)
175.4

Load Mix
47.0% INDUSTRIAL
10.9% COMMERCIAL
42.1% RESIDENTIAL

PORT OF OAKLAND

Commisioner
DAVID PEIXOTTO

Utility Director
WING LAU

Total Energy (GWh)
84.4

Load Mix
100% INDUSTRIAL

CITY OF REDDING

Commisioner
MARY STEGALL

Utility Director
JAMES FEIDER

Population
90,045

Total Energy (GWh)
839.6

Load Mix
04.7% INDUSTRIAL
47.5% COMMERCIAL
47.8% RESIDENTIAL

CITY OF ROSEVILLE

Commisioner
RICHARD ROCCUCCI

Utility Director
TOM HABASHI

Population
106,266

Total Energy (GWh)
1,273.9

Load Mix
29.2% INDUSTRIAL
35.5% COMMERCIAL
35.3% RESIDENTIAL

SILICON VALLEY POWER

Commisioner
PATRICK KOLSTAD

Utility Director
JOHN ROUKEMA

Population
114,238

Total Energy (GWh)
2,934.8

Load Mix
86.6% INDUSTRIAL
04.3% COMMERCIAL
09.2% RESIDENTIAL

TRUCKEE DONNER PUBLIC UTILITY DISTRICT

Commisioner
TIM TAYLOR

Utility Director
STEVE HOLLABAUGH

Population
16,019

Total Energy (GWh)
153.5

Load Mix
00.0% INDUSTRIAL
48.4% COMMERCIAL
51.6% RESIDENTIAL

TURLOCK IRRIGATION DISTRICT

Commisioner
LARRY WEIS

Utility Director
RANDY BAYSINGER

Population
199,993 (ESTIMATED SERVICE AREA)

Total Energy (GWh)
2,076.2

Load Mix
48.3% INDUSTRIAL
14.4% COMMERCIAL
37.3% RESIDENTIAL

CITY OF UKIAH

Commisioner
DOUG CRANE

Utility Director (Interim)
ELIZABETH KIRKLEY

Population
15,876

Total Energy (GWh)
123.9

Load Mix
02.9% INDUSTRIAL
64.2% COMMERCIAL
32.9% RESIDENTIAL

Source for Load Mixes:
Electric Sales and Revenue 2005
DOE/EIA-0540 (99)
Distribution Category UC-950

NCPA FINANCIAL STATEMENTS 2007

THE ATTACHED DISC CONTAINS NORTHERN CALIFORNIA POWER AGENCY AND ASSOCIATED POWER CORPORATIONS REPORT ON EXAMINATION OF FINANCIAL STATEMENTS AND OTHER FINANCIAL INFORMATION FOR THE YEAR ENDED JUNE 30, 2007. THIS DOCUMENT IS STORED IN THE ADOBE ACROBAT (PDF) FORMAT.

TO VIEW THE DOCUMENT YOU WILL NEED TO HAVE THE ADOBE ACROBAT READER® INSTALLED ON YOUR COMPUTER.

THE ACROBAT READER INSTALL FILES ARE LOCATED ON THIS CD IN THE FOLDER ACROBAT READERS. SELECT THE VERSION THAT MATCHES YOUR OPERATING SYSTEM (PC OR MAC).

THE PDF FILES ARE ALSO ACCESSABLE THROUGH THE NCPA WEBSITE AT WWW.NCPA.COM, OR BY CALLING THE NCPA MAIN OFFICE AT 916.781.3636.

ALL QUOTES IN THIS PIECE BY HENRY DAVID THOREAU

NCPA MANAGEMENT

General Manager
JAMES H. POPE

Assistant General Manager, Business Development
DON DAME

Assistant General Manager, Legislative and Regulatory Affairs
JANE DUNN CIRRINCIONE

Assistant General Manager, Power Management
DAVID DOCKHAM

CFO/Assistant General Manager, Administrative Services
DONNA STEVENER

Assistant General Manager, Generation Services
KEN SPEER

Human Resources Director
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Executive Assistant
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APPENDIX 1

NCPA STIG-1 Final Permit (EPA #CA194000002)

RECEIVED
9/23/2002

Underground Injection Control Program

FINAL PERMIT

Class I Non-Hazardous Waste Injection
Permit No. CA194000002

Well Name: NCPA - STIG #1
Lodi, California

Issued to:

Northern California Power Agency
STIG Combustion Turbine Project #2
12751 North Thornton Road
Lodi, CA 95242-1478

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PART I. AUTHORIZATION TO OPERATE

Pursuant to the Underground Injection Control regulations of the U.S. Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations, Parts 124, 144, 146, 147, and 148.

Northern California Power Agency
STIG Combustion Turbine Project #2
12751 North Thornton Road
Lodi, CA 95242-1478

is hereby authorized to engage in non- hazardous waste injection well identified as NCPA - STIG #1. The well is located in Section 24, T. 3 N., R. 5 E., in San Joaquin County, California.

Injection is authorized into the Domengine Sand Formation for the purpose of disposal of treated waste waters from a steam injection gas turbine power plant upon the express condition that the permittee meet the restrictions set forth herein.

All conditions set forth herein refer to Title 40 Parts 124, 144, 146, 147 and 148 of the Code of Federal Regulations and are regulations that are in effect on the date that this permit is effective.

This permit consists of 29 pages and includes all items listed in the Table of Contents. Further, it is based upon representations made by the permittee and on other information contained in the administrative record. It is the responsibility of the permittee to read and understand all provisions of this permit.

This permit and the authorization to inject are issued for a period of up to ten years unless terminated under the conditions set forth in Part III, Section B of this permit.

Issued this 18th day of October 1994

This permit shall become effective 10/18/94

for Alexis Strauss, Deputy
Harry Seraydarian, Director
Water Management Division, EPA Region 9

PART II. SPECIFIC PERMIT CONDITIONS

A. WELL CONSTRUCTION

1. Casing and Cementing The well schematic details submitted with the application are hereby incorporated into this permit as Appendix A, and shall be binding on the permittee. Notwithstanding any other provisions of this permit, the permittee shall case and cement the well to prevent the movement of fluids into or above underground sources of drinking water. The following specifications apply to the injection well:

   Surface casing - The surface casing is run and set at approximately 611 feet as an anchor for the surface pressure control equipment (BOPE). This string of casing is 10-3/4 inch O.D., K-55 steel, weighing 40.5 pounds per foot (ppf). ST & C casing cemented from the surface to a depth of 611 feet with the cement returned to surface.

   Intermediate casing - The intermediate casing is run and set at approximately 3660 feet into an impermeable shale section identified while drilling. This string of casing is 7 inch O.D., K-55 steel, weighing 20 pounds per foot (ppf). It is installed in 40 foot lengths and joined by non-upset 8-round threaded couplings. This 7 inch string is cemented from the bottom of the casing to the top with the cement returned to surface.

   Liner - The liner is hung and set from approximately 3358 feet to 4645 feet through the zone of intended injection. This string of casing is 5 inch O.D., J-55 steel, weighing 15 pounds per foot (ppf). This 5 inch liner was perforated selectively in the sands of the Domengine formation. A net 222 feet of perforations were shot within the interval 4234 and 4573 feet.

   Tubing - Injection is through a 4 1/2 inch O.D., tubing, J-55 steel, and packer.

2. Tubing and Packer Specifications Injection will take place only through the 4 1/2 inch tubing with a Baker Lok-Set Packer set within the long string casing at approximately 892 feet above the injection zone. The tubing and packers shall be maintained to prevent the movement of fluids into an underground source of drinking water. The tubing and packers shall be corrosion-resistant and of sufficient strength to resist wellbore pressures developed during the life of the well. The casing/tubing annulus will be filled with corrosion inhibited fluid. Injection between the outermost casing and the wellbore is prohibited.

3. Injection Intervals Injection into the intended zone is through perforations made through the steel casing and cement into the zone of injection by 11-gram jet charges at 4 shots per foot, 120 degrees phasing, in 3-1/8 inch hollow steel carrier guns. Perforations are 0.31 inch diameter holes penetrating 18.9 inches. Injection shall be permitted for the lower Domengine Formation, between 4220 feet and 4559 feet below the ground surface. Alteration of the injection perforations and other rework operations must be properly reported (EPA Form 7520-12) and the well must demonstrate mechanical integrity before injection is authorized.

4. Monitoring Devices The operator shall install and maintain in good operating condition:

   (a) A tap on the suction line prior to the injection pump and the wellhead for the purpose of obtaining representative samples of the injection fluids;

   (b) A pressure, temperature and flow transmitter to measure and transmit to a computer-based data acquisition system the parameters lited in Part II, Section D.4 of this permit. The flow transmitter and totalizer shall yield measured cumulative volumes that are certified for a deviation accuracy of five (5) percent or less throughout the range of injection rates allowed by the permit; and

   check with Grum on calibrate gauges check gauges x

   (c) A pressure gauge designed to provide (1) a full pressure range of 100 percent greater than the anticipated operating pressure, and (2) a certified deviation accuracy of five (5) percent or less.

5. Proposed Changes and Workovers The permittee shall give advance notice to the Director, as soon as possible, of

any planned physical alterations or additions to the permitted injection well. Any changes in the well construction will require prior approval of the EPA and a permit modification under the requirements of 40 CFR 144.39. In addition, the permittee shall provide all records of well workovers, logging, or other subsequent test data, including required mechanical integrity testing, to EPA within sixty (60) days of completion of the activity. Appendix B contains samples of the appropriate reporting forms. Demonstration of mechanical integrity shall be performed within thirty (30) days of completion of workovers or alterations and prior to resuming injection activities, in accordance with Part II, Section C.1. (a).

B. CORRECTIVE ACTION

No corrective action for wells located within the Area of Review will be required pursuant to 40 CFR 144.55 and 40 CFR 146.7.

C. WELL OPERATION

1. Prior to Commencing Injection Injection operations may not commence until the permittee has complied with items (a) and (b) as follows:

   (a) All construction and testing is complete; and

      (i) The Director has inspected or otherwise reviewed the injection well and notified the operator that it is in compliance with the conditions of the permit; or

      (ii) The permittee has received notice from the Director of his or her intent not to inspect or otherwise review the injection well; and

   (b) The permittee demonstrates that the well has mechanical integrity in accordance with 40 CFR 146.8 and has received written notice from the Director that such a demonstration is satisfactory. The permittee shall notify EPA of its intent to demonstrate mechanical integrity at least thirty (30) days prior to such demonstration.

2. Mechanical Integrity

(a) Method for Demonstrating Mechanical Integrity A demonstration of the absence of significant leaks in the casing, tubing and/or packer must be made by performing a tubing/casing annulus pressure test. This test shall be for a minimum of thirty (30) minutes at a pressure equal to the maximum allowable injection pressure. A well passes the mechanical integrity test if there is less than a five (5) percent decrease/increase in pressure over the thirty (30) minute period. The tubing/casing annulus pressure and injection pressures must be monitored continuously and the average, maximum, and minimum monthly results are included in the quarterly report to the director.

(b) Schedule for Demonstrations of Mechanical Integrity

(i) A demonstration of mechanical integrity shall be made no less frequently than every year from the effective date of this permit, in accordance with 40 CFR 146.8 and paragraph (a) above. Mechanical integrity shall also be demonstrated any time that a workover is conducted, the construction of the well is modified or when loss of mechanical integrity becomes evident during operation.

might require 1x/yr. radioactive tracer survey + Temp. Survey 1x/5yrs

(ii) It shall be the permittee's responsibility to arrange and conduct the mechanical integrity demonstrations. The permittee shall notify the Director of its intent to demonstrate mechanical integrity at least thirty (30) days prior to each such demonstration. Results of the test shall be submitted to the Director as soon as possible but no later than sixty (60) days after the demonstration.

Special situations req. if problems had been detected

(iii) In addition to any demonstration made under paragraph (i) above, the Director may require a demonstration of mechanical integrity at any time during the life of the well.

(c) Loss of Mechanical Integrity If (1), the well fails to demonstrate mechanical integrity during a test, or (2), a loss of mechanical integrity becomes evident during operation, or (3), a significant

change in the annulus or injection pressure occurs during normal operating conditions, the permittee shall notify the Director in accordance with Part III, Section E.10 of this permit. Furthermore, injection activities shall be terminated immediately and operation shall not be resumed until the permittee has taken necessary actions to restore integrity to the well and EPA gives approval to recommence injection.

3. Confining Layer The injection formation is confined by a 117 foot thick marine shale accompanied by minor amounts of microlignitic siltstone of the Nortonville formation which immediately overlies the Domengine formation

4. Injection Pressure Limitation

(a) Injection pressure measured at the wellhead shall not exceed 975 psig for injection into the Domengine formation, based on a fracture pressure gradient of 0.73 psi per foot. In no case shall injection pressure initiate fractures in the confining zone, or cause the movement of injection, or formation fluids into an underground source of drinking water (USDW).

(b) The injection pressure limitations in paragraph (a) may be increased by the Director based on the results of a valid step-rate injection test in the respective proposed injection zone(s). The Director will determine any allowable increase based upon the step-rate test results and other parameters reflecting actual injection operations.

(c) Any approval granted by the Director for the increased pressure limitations as stated in paragraph (b) shall be made part of this permit by minor modification without further opportunity for public comment.

5. Injection Volume (Rate) Limitation

(a) The injection rate shall not exceed 200 gpm at any time.

(b) The permittee may request an increase in the maximum rate allowed in paragraph (a). Any such request shall be made in writing to the Director.

(c) Should any increase in rate be requested, the permittee shall demonstrate to the satisfaction of

the Director that the increase in volume will not interfere with the operation of the facility or its ability to meet conditions described in the permit and would not change its classification.

6. Injection Fluid Limitation

(a) The permittee shall not inject any hazardous wastes as defined by 40 CFR 261, at any time during the operation of the facility.

(b) 98% of the injection fluid shall consist of brine reject from the ultrafiltration units, reverse osmosis units and the blowdown from the cooling towers. The other 2% of the liquid wastes intended for injection will consist of both continuous and intermittent blowdown from the Heat Recovery Boilers.

(c) The injection of any fluids other than those described in paragraph (b), above, shall be reported to the Director thirty (30) days prior to the injection of the substance. Written approval by the Director is required for change of injection fluids.

7. Annulus Measurements The annulus between the tubing and the long string casing will contain approximately 449 cubic feet (3360 gallons) of corrosion inhibiting fluid to prevent corrosion of the casing and bacterial growth. A minimum surface annular pressure of 100 psig shall be maintained at all times.

D. MONITORING, RECORDKEEPING, AND REPORTING OF RESULTS

1. Injection Well Monitoring Program Samples and measurements shall be representative of the monitored activity. The permittee shall utilize the applicable analytical methods described in Table I of 40 CFR 136.3, or in Appendix III of 40 CFR 261, or in certain circumstances, other methods that have been approved by the EPA Administrator. Reporting shall consist of average, maximum, and minimum daily and monthly values for injection pressure, annular pressure, flow rate, temperature and volume.

Temperature, annular pressure, and injection pressure shall be measured at the wellhead. Injection rate/flow rate shall be measured in the supply line immediately before the wellhead.

2. Injection Fluid Monitoring Program Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The method used to obtain a representative sample of the fluid to be analyzed and the procedure for analysis of the sample are as follows:

(a) Wellhead Injection Water
(i) Grab samples shall be collected at the sampling valve at the wellhead and used for laboratory analysis for physical and chemical characteristics.

3. Injection Fluid Analysis Injection fluids shall be analyzed no less frequently than indicated for the following parameters:

Parameter	Monitoring Frequency	Sample Type
specific gravity, unitless	Quarterly	grab
conductivity, mhos	Quarterly	grab
hardness, mg/l as $CaCO_3$	Quarterly	grab
total dissolved solids, mg/l	Quarterly	grab
pH, standard units	Quarterly	grab
Arsenic 5 mg/L	Quarterly	grab
Barium — 100 mg/L	Quarterly	grab
Boron	Quarterly	grab
Cadmium — 1 mg L	Quarterly	grab
Calcium	Quarterly	grab
Chloride	Quarterly	grab
Chromium — 5 mg L	Quarterly	grab
Copper	Quarterly	grab
Fluoride	Quarterly	grab
Lead — 5 mg/L	Quarterly	grab
Magnesium	Quarterly	grab
M-Alkalinity	Quarterly	grab
Mercury — 0.2 mg/L	Quarterly	grab
Nitrate	Quarterly	grab
Potassium	Quarterly	grab
Selenium — 1 mg/L	Quarterly	grab
Silver — 5 mg/L	Quarterly	grab
Silica	Quarterly	grab
Sodium	Quarterly	grab
Sulfate	Quarterly	grab
Vanadium	Quarterly	grab
Zinc	Quarterly	grab
Benzene — 0.5 mg/L	Quarterly	grab
Toluene	Quarterly	grab
Trichloroethylene — 0.5 mg/L	Quarterly	grab
Phenol	Quarterly	grab

4. Injection Fluid Monitoring Data

Parameter	Monitoring Frequency	Instrument
injection rate, gpm	continuous	recorder
injection total volume, gallons	continuous	totalizer
injection pressure, psig	continuous	recorder
annular pressure, psig	continuous	recorder
injection fluid temperature, deg F	continuous	recorder

The injection fluid monitoring data is to be recorded continuously, and a computer-based data acquisition system may be used for this purpose. Each of the above five parameters is to be automatically scanned every second, and a continuous record is to be made of the injection rate, injection volume and injection pressure measurements. The continuous annular pressure and injection fluid temperature measurements are to be individually averaged and recorded each hour.

Check DCS.

5. Calibration of Monitoring Equipment All monitoring and recording equipment shall be calibrated on a regular basis. The permittee shall submit, to the Director, a report describing the calibration procedures and the frequency at which the equipment will be calibrated.

6. Automatic Alarms and Shut-Off Devices The permittee shall continuously operate and maintain an automatic warning system which will immediately notify the operators of a malfunction in the event that the injection pressure at the wellhead exceeds the maximum injection pressure authorized by this permit.

7. Monitoring Information Records of any monitoring activity required under this permit shall include:

   (a) The date, exact place, and time of sampling or field measurements;

   (b) The name of the individual(s) who performed the sampling or measurements;

   (c) The exact sampling method(s) used to take samples;

   (d) The date(s) laboratory analysis were performed;

   (e) The name of the individual(s) who performed the analyses;

(f) The analytical techniques or methods used by laboratory personnel; and

(g) The results of such analyses.

8. Recordkeeping

(a) The permittee shall retain records concerning:

(i) the nature and composition of all injected fluids until three (3) years after the well has been plugged and abandoned.

(ii) all monitoring information, including all calibration and maintenance records and all recordings for continuous monitoring instrumentation and copies of all reports required by this permit for a period of at least five (5) years from the date of the sample, measurement or report throughout the operating life of the well.

(b) The permittee shall continue to retain such records after the retention period specified in paragraphs (a) (i) and (a) (ii) unless it delivers the records to the Director or obtains written approval from the Director to discard the records.

(c) The permittee shall maintain copies (or originals) of all pertinent observation records available for inspection at the facility.

9. Reporting of Results The permittee shall submit short and accurate quarterly reports to the Director containing the following information:

(a) Results of the injection fluid analyses specified in permit condition Part II, Section D, Item 3.

(b) Average, maximum, and minimum monthly values for the continuously monitored parameters specified in Part II, Section D, Item 4.

(c) Equipment calibration.

(d) A narrative description of all non-compliance that occurred during the reporting period.

Monitoring results obtained during each calendar month shall be summarized for each month and reported on EPA Form 7520-8. Forms shall be submitted for the reporting

periods by the respective due dates as listed below:

Reporting Period	Report Due
Jan, Feb, Mar	Apr 28
Apr, May, June	Jul 28
July, Aug, Sept	Oct 28
Oct, Nov, Dec	Jan 28

Copies of the monitoring results and all other reports required by this permit shall be submitted to the following addresses:

U.S. Environmental Protection Agency, Region 9
Water Management Division
Source Water Protection Section (W-6-3)
75 Hawthorne St.
San Francisco, CA 94105

E. PLUGGING AND ABANDONMENT

1. Notice of Plugging and Abandonment The permittee shall notify the Director no later than 45 days before further conversion, workover, or abandonment of the well. The Director may require that the plugging and abandonment be witnessed by an EPA representative.

2. Plugging and Abandonment Plan The permittee shall plug and abandon the well as provided in the Plugging and Abandonment Plan in Appendix C. The EPA reserves the right to change the manner in which the well will be plugged if the well is modified during its permitted life or if the well is not consistent with EPA requirements for construction or mechanical integrity. The Director may ask the permittee to estimate and to update the estimated plugging cost periodically. Such estimates shall be based upon costs which a third party would incur to plug the well according to the plan.

3. Plugging and Abandonment Report Within sixty (60) days after plugging the well, the permittee shall submit a report on Form 7520-13 to the Director. The report shall be certified as accurate by the person who performed the plugging operation and the report shall consist of either: (1) a statement that the well was plugged in accordance with the plan, or (2) where actual plugging differed from the plan, a statement specifying the

different procedures followed.

4. Cessation of Injection Activities After a cessation of injection of two (2) years, the permittee shall plug and abandon the well in accordance with the Plugging and Abandonment Plan, unless it:

   (a) Provides notice to the Director; and

   (b) Has demonstrated that the well will be used in the future, and

   (c) Has described actions or procedures, satisfactory to the Director, that will be taken to ensure that the well will not endanger USDWs during the period of temporary abandonment.

F. FINANCIAL RESPONSIBILITY

1. Demonstration of Financial Responsibility The permittee is required to maintain financial responsibility and resources to close, plug, and abandon the underground injection operation as provided in the plugging and abandonment plan.

   (a) The permittee shall maintain a bond rating within the four highest categories of Standard and Poor's (AAA, AA, A, or BB) or Moody's (Aaa, Aa, A, or Baa). If the most recent bond rating does not fall within the four highest categories, then the permittee shall post a financial instrument such as a bond, letter of credit, or a trust fund to guarantee closure of the well.

   (b) The permittee must provide proof to the EPA of its bond rating or renewal every year by March 31.

2. Insolvency of Financial Institution The permittee must submit an instrument of financial responsibility acceptable to the Director within sixty (60) days after either of the following events occur:

   (a) the institution issuing the bond or financial instrument files for bankruptcy; or

   (b) the authority of the trustee institution to act as

trustee, or the authority of the institution issuing the financial instrument is suspended or revoked.

PART III. GENERAL PERMIT CONDITIONS

A. EFFECT OF PERMIT

The permittee is allowed to engage in underground injection well construction in accordance with the conditions of this permit. The permittee, authorized by this permit, shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 141 or may otherwise adversely affect the health of persons. Furthermore, any underground injection activity not specifically authorized in this permit is prohibited. Compliance with this permit during its term constitutes compliance for purposes of enforcement with Part C of the Safe Drinking Water Act (SDWA). Such compliance does not constitute a defense to any action brought under Section 1431 of the SDWA, or any other common or statutory law other than Part C of the SDWA. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Nothing in this permit shall be construed to relieve the permittee of any duties under applicable regulations.

B. PERMIT ACTIONS

1. <u>Modification, Revocation, Reissuance and Termination</u> The Director may, for cause or upon request from the permittee, modify, revoke and reissue, or terminate this permit in accordance with 40 CFR 124.5, 144.12, 144.39, and 144.40. Also, the permit is subject to minor modifications for cause as specified in 40 CFR 144.41. The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes, or anticipated noncompliance on the part of the permittee does not stay

the applicability or enforceability of any permit condition. The Director may also modify, revoke and reissue, or terminate this permit in accordance with any amendments to the SDWA if the amendments have applicability to this permit.

2. Transfer of Permits This permit is not transferable to any person except after notice is provided to the Director and the permittee complies with the requirements of 40 CFR 144.38. The Director may require modification of revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the SDWA.

C. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

D. CONFIDENTIALITY

In accordance with 40 CFR 2 and 144.5, any information submitted to EPA pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice.

E. GENERAL DUTIES AND REQUIREMENTS

1. Duty to Comply The permittee shall comply with all applicable UIC Program regulations and conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit issued in accordance with 40 CFR 144.34. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. Such noncompliance may also be grounds for enforcement action under the Resource Conservation and Recovery Act (RCRA).

2. Penalties for Violations of Permit Conditions Any person who violates a permit requirement is subject to civil penalties, fines, and other enforcement action under the SDWA and may be subject to such actions pursuant to RCRA.

Any person who willfully violates permit conditions may be subject to criminal prosecution.

3. Need to Halt or Reduce Activity not a Defense It shall not be a defense, for the permittee in an enforcement action, that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. Duty to Mitigate The permittee shall take all reasonable steps to minimize and correct any adverse impact on the environment resulting from noncompliance with this permit.

5. Proper Operation and Maintenance The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.

6. Duty to Provide Information The permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

7. Inspection and Entry The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

   (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this permit;

   (b) Have access to and copy, at reasonable times, any records that are kept under the conditions of this permit;

   (c) Inspect and photograph at reasonable times any

facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

(d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any location.

8. Records of the Permit Application The permittee shall maintain records of all data required to complete the permit application and any supplemental information submitted for a period of five (5) years from the effective date of this permit. This period may be extended by request of the Director at any time.

9. Signatory Requirements All reports or other information requested by the Director shall be signed and certified by a responsible corporate officer or duly authorized representative according to 40 CFR 144.32.

10. Reporting of Noncompliance

(a) Anticipated Noncompliance The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(b) Compliance Schedules Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than thirty (30) days following each schedule date.

(c) Twenty-four Hour Reporting.

(i) The permittee shall report to the Director any noncompliance which may endanger health or the environment. Information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which must be reported orally within 24 hours:

(A) Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water.

(B) Any noncompliance with a permit condition, or malfunction of the injection system, which may cause fluid migration into or between underground sources of drinking water.

(ii) A written submission shall also be provided within five (5) days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

(d) Other Noncompliance The permittee shall report all other instances of noncompliance not otherwise reported at the time monitoring reports are submitted. The reports shall contain the information listed in Part III, Section E.10.(c)(ii) of this permit.

(e) Other Information Where the permittee becomes aware that it failed to submit all relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the permittee shall submit such facts or information within two (2) weeks of the time such information becomes known.

11. Continuation of Expiring Permits

(a) Duty to Reapply If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must submit a complete application for a new permit at least 180 days before this permit expires.

(b) Permit Extensions The conditions of an expired permit may continue in force in accordance with 5 U.S.C. 558(c) until the effective date of new permit, if:

(i) The permittee has submitted a timely application which is a complete application for a new permit;

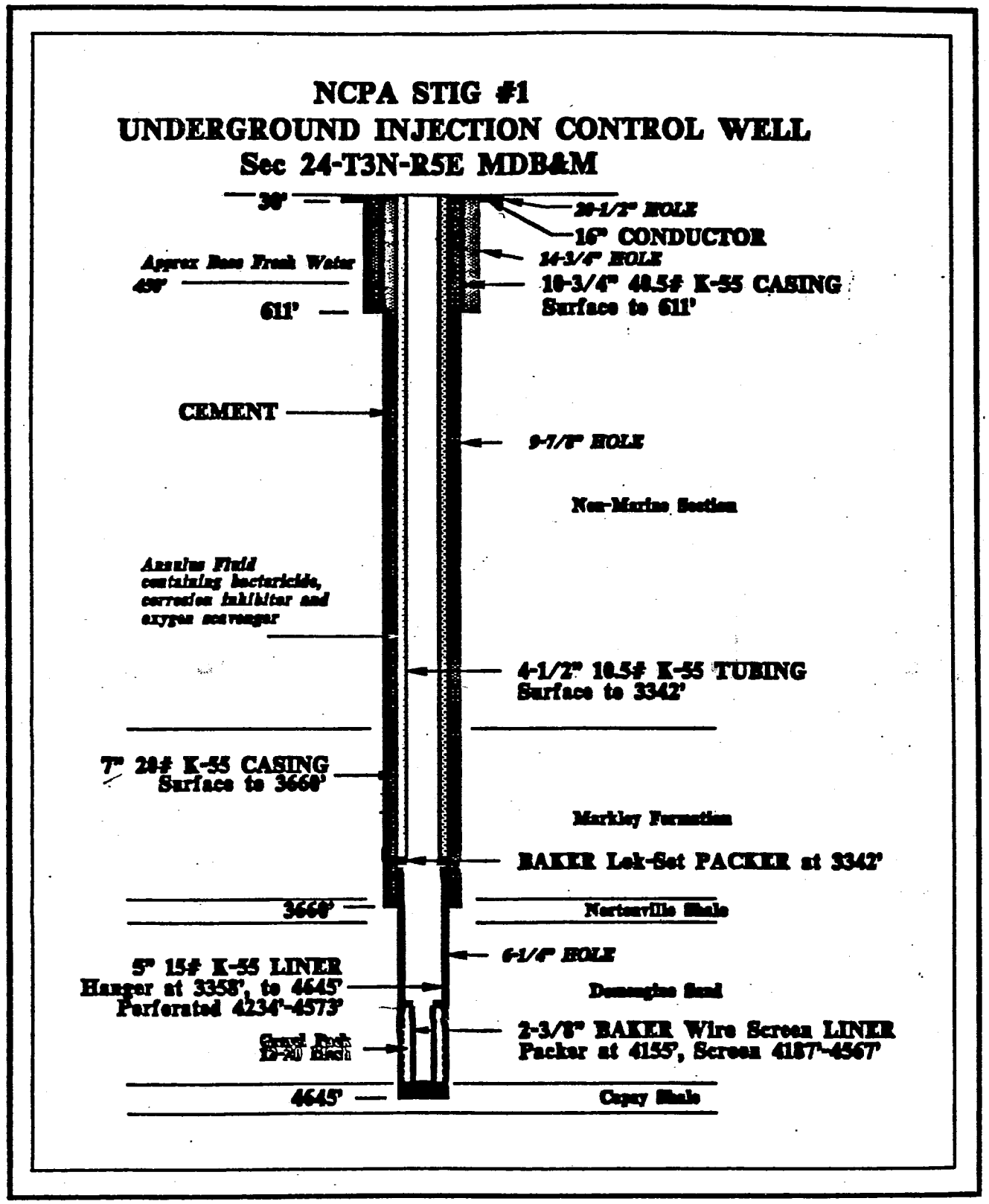
(ii) The Director, through no fault of the

permittee, does not issue a new permit with an effective date on or before the expiration date of the previous permit; and

(iii) The new permit has not been denied, and if a denial has been appealed, the denial has not been upheld on appeal. (The appeal is still pending or has resulted in a reversal of the denial of the new permit application.)

APPENDIX A - WELL CONSTRUCTION PLAN

WELL CONSTRUCTION PLAN



NCPA
Northern California Power Agency

NCPA STIG #1 Injection Well
Lodi California

WELLBORE SCHEMATIC

DRAWN BY	DATE	SCALE	FIGURE
JLS	7/93	As Shown	M1-2

APPENDIX B - REPORTING FORMS

Form Approved. OMB No. 2040-0042. Expires 9-30-91

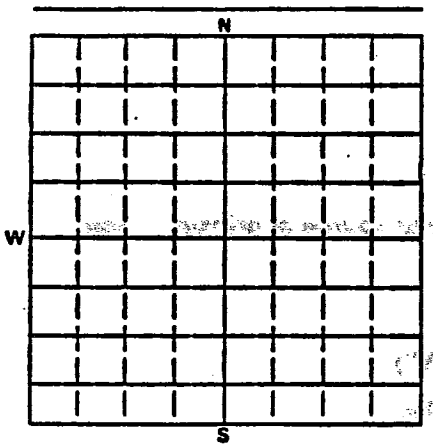
EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

APPLICATION TO TRANSFER PERMIT

NAME AND ADDRESS OF EXISTING PERMITTEE	NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES



STATE	COUNTY	PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY	WELL STATUS	TYPE OF PERMIT
☐ Class I	☐ Operating	☐ Individual
☐ Class II	☐ Modification/Conversion	☐ Area
☐ Brine Disposal	☐ Proposed	Number of Wells _____
☐ Enhanced Recovery		
☐ Hydrocarbon Storage		
☐ Class III		
☐ Other		

Lease Name Well Number

NAME(S) AND ADDRESS(ES) OF NEW OWNER(S)	NAME AND ADDRESS OF NEW OPERATOR

Attach to this application a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them.

The new permittee must show evidence of financial responsibility by the submission of surety bond, or other adequate assurance, such as financial statements or other materials acceptable to the director.

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Well Class and Type Codes

Class I	Wells used to inject waste below the deepest underground source of drinking water.
Type "I"	Nonhazardous industrial disposal well
"M"	Nonhazardous municipal disposal well
"W"	Hazardous waste disposal well injecting below USDW's
"X"	Other Class I wells (not included in Type "I," "M," or "W")
Class II	Oil and gas production and storage related injection wells.
Type "D"	Produced fluid disposal well
"R"	Enhanced recovery well
"H"	Hydrocarbonn storage well (excluding natural gas)
"X"	Other Class II wells (not included in Type "D," "R," or "H")
Class III	Special process injection wells.
Type "G"	Solution mining well
"S"	Sulfur mining well by Frasch process
"U"	Uranium mining well
"X"	Other Class III wells (not included in Type "G," "S," or "U")
Other Classes	Wells not included in classes above.
	Class V wells which may be permitted under §144.12
	Wells not currently classified as Class I, II, III, or V.

EPA Form 7520-7 (2-84) Reverse

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this collection of information is estimated at an average of 2 hours per transfer, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency 401 M Street, SW Washington, DC 20460, and to the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

Form Ap. Jvea.. OMB No. 2040-0042. Expires 9-30-91

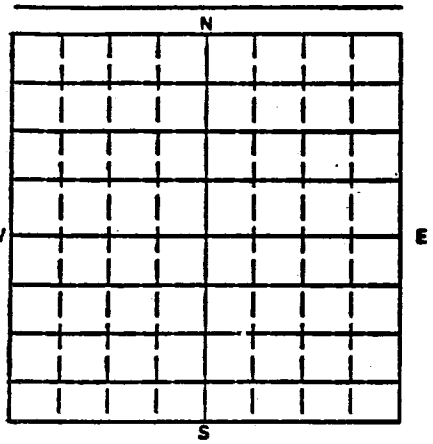
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

ANNUAL DISPOSAL/INJECTION WELL MONITORING REPORT

NAME AND ADDRESS OF EXISTING PERMITTEE	NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES



STATE	COUNTY	PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY

- ☐ Brine Disposal
- ☐ Enhanced Recovery
- ☐ Hydrocarbon Storage

TYPE OF PERMIT

- ☐ Individual
- ☐ Area

Number of Wells _____

Lease Name Well Number

	INJECTION PRESSURE		TOTAL VOLUME INJECTED		TUBING — CASING ANNULUS PRESSURE (OPTIONAL MONITORING)	
MONTH YEAR	AVERAGE PSIG	MAXIMUM PSIG	BBL	MCF	MINIMUM PSIG	MAXIMUM PSIG

CERTIFICATION

ertify under the penalty of law that I have personally examined and am familiar with the information submitted in his document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this collection of information is estimated at an average of 16 hours per operator, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency 401 M Street, SW, Washington, DC 20460, and to the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

Form Approved. OMB No. 2040-0042. Expires 9-30-91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

WELL REWORK RECORD

NAME AND ADDRESS OF PERMITTEE	NAME AND ADDRESS OF CONTRACTOR

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES

N
W E
S

STATE	COUNTY	PERMIT NUMBER

SURFACE LOCATION DESCRIPTION
¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location ____ ft. from (N/S) ____ Line of quarter section

and ____ ft. from (E/W) ____ Line of quarter section

WELL ACTIVITY	Total Depth Before Rework	TYPE OF PERMIT
☐ Brine Disposal ☐ Enhanced Recovery ☐ Hydrocarbon Storage	Total Depth After Rework	☐ Individual ☐ Area Number of Wells ____
Lease Name	Date Rework Commenced	Well Number
	Date Rework Completed	

WELL CASING RECORD — BEFORE REWORK

Casing		Cement		Perforations		Acid or Fracture Treatment Record
Size	Depth	Sacks	Type	From	To	

WELL CASING RECORD — AFTER REWORK *(Indicate Additions and Changes Only)*

Casing		Cement		Perforations		Acid or Fracture Treatment Record
Size	Depth	Sacks	Type	From	To	

DESCRIBE REWORK OPERATIONS IN DETAIL USE ADDITIONAL SHEETS IF NECESSARY	WIRE LINE LOGS, LIST EACH TYPE	
	Log Types	Logged Intervals

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Paperwork Reduction Act Notice

Public reporting burden for this collection of information is estimated at an average of 4 hours per well, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, and the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

Form Approved. OMB No. 2040-0042. Approval expires 9-30-91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

PLUGGING AND ABANDONMENT PLAN

NAME AND ADDRESS OF FACILITY

NAME AND ADDRESS OF OWNER/OPERATOR

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES

N

W E

S

STATE | COUNTY | PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

TYPE OF AUTHORIZATION

- ☐ Individual Permit
- ☐ Area Permit
- ☐ Rule

Number of Wells _____

Lease Name

WELL ACTIVITY

- ☐ CLASS I
- ☐ CLASS II
  - ☐ Brine Disposal
  - ☐ Enhanced Recovery
  - ☐ Hydrocarbon Storage
- ☐ CLASS III

Well Number

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT(LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☐ The Balance Method
- ☐ The Dump Bailer Method
- ☐ The Two-Plug Method
- ☐ Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inches)							
Depth to Bottom of Tubing or Drill Pipe (ft.)							
Sacks of Cement To Be Used (each plug)							
Slurry Volume To Be Pumped (cu. ft.)							
Calculated Top of Plug (ft.)							
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)							
Type Cement or Other Material (Class III)							

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED *(If any)*

From	To	From	To

Estimated Cost to Plug Wells

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

DATE SIGNED

Paperwork Reduction Act Notice

Public reporting burden for this collection of information is estimated at an average of 4 hours per well, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, and the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

INJECTION WELL MONITORING REPORT

Form Approved
OMB No. 2040-0042
Approval expires 9-30-91

YEAR	MONTH	-MONTH	MONTH
Injection Pressure (PSI)			
1. Minimum			
2. Average			
3. Maximum			
Injection Rate (Gal/Min)			
1. Minimum			
2. Average			
3. Maximum			
Annular Pressure (PSI)			
1. Minimum			
2. Average			
3. Maximum			
Injection Volume (Gal)			
onthly Total			
2. Yearly Cumulative			
Temperature (F°)			
1. Minimum			
2. Average			
3. Maximum			
pH			
1. Minimum			
2. Average			
3. Maximum			
Other			

Name and Address of Permittee	Permit Number
Name and Official Title (Please type or print) / Signature	Date Signed

PAPERWORK REDUCTION ACT NOTICE

Public reporting burden for this collection of information is estimated at an average of 50 hours for Class I wells, 16 hours for Class II wells, and 40 hours for Class III wells annually, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency 401 M Street, SW Washington, DC 20460, and to the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

Form Approved. OMB No. 2040-0042
Approval expires 9-30-91

EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

COMPLETION FORM FOR INJECTION WELLS

ADMINISTRATIVE INFORMATION

1. Permittee

Address *(Permanent Mailing Address) (Street, City, State, and ZIP Code)*

2. Operator

Address *(Street, City, State, and ZIP Code)*

3. Facility Name

Telephone Number

Address *(Street, City, State, and ZIP Code)*

4. Surface Location Description of Injection Well(s)

State	County	
¼ of	¼ of	¼ section
Township	Range	
Feet from (N/S)	Line of quarter section and	
Feet from (E/W)	Line of quarter section	

Submit with this Completion Form the attachments listed in *Attachments for Completion Form.*

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Attachments to be submitted with the Completion report:

Geologic Information

. Lithology and Stratigraphy

.. Provide a geologic description of the rock units pene-
ated by name, age, depth, thickness, and lithology of
ach rock unit penetrated.

.. Provide a description of the injection unit.

1) Name
2) Depth (drilled)
3) Thickness
4) Formation fluid pressure
5) Age of unit
6) Porosity (avg.)
7) Permeability
8) Bottom hole temperature
9) Lithology
10) Bottom hole pressure
11) Fracture pressure

C. Provide chemical characteristics of formation fluid attach chemical analysis).

D. Provide a description of freshwater aquifers.

(1) Depth to base of fresh water (less than 10,000 mg/1 TDS).

(2) Provide a geologic description of aquifer u s with name, age, depth, thickness, lithology, and ave ge total dissolved solids.

II. Well Design and Construction

1. Provide data on surface, intermediate, and long string casing and tubing. Data must include material, size, weight, grade, and depth set.

2. Provide data on the well cement, such as type/class, additives, amount, and method of emplacement.

3. Provide packer data on the packer (if used) such as type, name and model, setting depth, and type of annular fluid used.

4. Provide data on centralizers to include number, type and depths.

5. Provide data on bottom hole completions.

6. Provide data on well stimulation used.

III. Description of Surface Equipment

1. Provide data and a sketch of holding tanks, flow lines, filters, and ection pump

IV. Monito g Systems

1. Provide data on recording and nonrecording injection pressure gauges, casing-tubing annulus pressure gauges, injection rate meters, temperature meters, and other meters or gauges.

2. Provide data on constructed monitor wells such as location, depth, casing diameter, method of cementing, etc.

V. Logging and Testing Results

Provide a descriptive report interpreting the results of geophysical logs and other tests. Include a description and data on deviation checks run during drilling.

VI. Provide an as-built diagrammatic sketch of the injection well(s) showing casing, cement, tubing, packer, etc., with proper setting depths. The sketch should include well head and gauges.

VII. Provide data demonstrating mechanical integrity pursuant to 40 CFR 146.08.

VIII. Report on the compatibility of injected wastes with fluids and minerals in both the injection zone and the confining zone.

IX. Report the status of corrective action on defective wells in the area of review.

X. Include the anticipated maximum pressure and flow rate at which injection will operate.

Paperwork Reduction Act Notice

Public reporting burden for this collection of information is estimated at an average of 4 hours per well, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, and the Office of Management and Budget, Paperwork Reduction Project, Washington, DC 20503.

APPENDIX C - PLUGGING AND ABANDONMENT PLAN

Upon completion of injection activities the well will be abandoned according to State and Federal regulations to ensure protection of USDW sources.

The proposed plugging and abandonment plan is as follows:

1. Move in and rig up a workover/completion rig, remove the wellhead, and install and activate BOPE. Run in hole and unseat the packer at 3342 feet and pull the 4-1/2 inch Tubing string and packer out of the well.

2. After sufficient fresh water has been injected to displace all the wellbore fluids, check for fill to confirm the wellbore is open to a depth of at least 100 feet below the 5 inch Liner hanger, to about 3460 feet. If not, bail well down to that depth.

3. Run open-ended 2-3/8 inch tubing with 1200 feet of 1-1/4 inch 10 RND, EUE, N-80 tubing stringer to at least 3460 feet, but as deep as possible down to a maximum depth of 4567 feet, and cement through tubing a premium cement plug, by coordinating the pumping of cement and gradual withdrawal of tubing, until the tubing has been pulled up to depth of 3160 feet, 200 feet above the liner lap. A 280 cubic foot cement plug will be sufficient to fill the well from 4567 feet to 3160 feet with almost 100% excess.

4. Wait on cement for 12 hours, run in hole with tubing tag top of cement plug, recementing if needed until the plug is confirmed to extend a minimum of 100 feet above the liner lap.

5. Pull up to a depth of 100 feet and set a 400 cubic foot (about 100% excess) cement plug to the surface.

6. After removing the BOPE and moving off the rig, cut off the wellhead and casing at ground level and weld a steel plate at least 3/8 inch thick to cap off the 7 inch Casing.

The above plugging and abandonment plan has been reasonably estimated by NCPA to be about $18,300.

STATE OF CALIFORNIA - Environmental Protection Agency PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Routier Road, Suite A
Sacramento, CA 95827-3098
PHONE: (916) 255-3000
FAX: (916) 255-3015

File 4-10100

2 November 1994

Scott E.
Mike A.
FYI.

Mr. Michael W. McDonald
Northern California Power Agency
180 Cirby Way
Roseville, CA 95678-6420

CERTIFIED MAIL
Z 079 346 032

WAIVER OF WASTE DISCHARGE REQUIREMENTS, NORTHERN CALIFORNIA POWER AGENCY, CLASS I INJECTION WELL, LODI, SAN JOAQUIN COUNTY

Enclosed is an official copy of Resolution No. 94-321, as amended by the California Regional Water Quality Control Board, Central Valley Region, at its last regular meeting.

Kenneth D. Landau

KENNETH D. LANDAU
Senior Engineer

PHL:pl

Enclosure

cc+Encl: Office of Drinking Water, Department of Health Services, Sacramento
Environmental Management Branch, Department of Health Services, Sacramento
Department of Water Resources, Central District, Sacramento
Department of Fish and Game, Region 2, Rancho Cordova
Office of the Chief Counsel, State Water Resources Control Board, Sacramento
Division of Water Quality, State Water Resources Control Board, Sacramento
San Joaquin County Department of Public Health Services
San Joaquin County Planning Department, Stockton
City of Lodi, Water/Wastewater Division, Stockton

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

RESOLUTION NO. 94-321

WAIVER OF
REPORT OF WASTE DISCHARGE
AND
WASTE DISCHARGE REQUIREMENTS
FOR
NORTHERN CALIFORNIA POWER AGENCY
CLASS I INJECTION WELL
SAN JOAQUIN COUNTY

WHEREAS, the Board received a draft Underground Injection Control (UIC) permit (UIC Permit #CA194000002) from the United States Environmental Protection Agency (EPA), on 2 September 1994; and

WHEREAS, EPA proposes to issue to Northern California Power Agency an UIC Permit for a Class I nonhazardous well; and

WHEREAS, the Class I nonhazardous well will be used to inject wastewater consisting of brine from ultrafiltration units and reverse osmosis units, cooling tower blowdown, and boiler blowdown, at a maximum rate of 200 gallons per minute; and

WHEREAS, injection shall be limited to the lower Domengine Formation between approximately 4234 and 4507 feet below the ground surface; and

WHEREAS, the total dissolved solids of the lower Domengine Formation fluid is approximately 14,000 mg/l; and

WHEREAS, Water Code Section 13260(a) states in part that any person operating or proposing to construct an injection well shall file with the regional board a report of the discharge; and

WHEREAS, Water Code Section 13260(b) states that no Report of Waste Discharge need be filed if the requirement is waived pursuant to Section 13269; and

WHEREAS, Water Code Section 13263(a) states in part that the regional board, after any necessary hearing, shall prescribe requirements as to the nature of any proposed discharge, or material change therein; and

WHEREAS, Water Code Section 13269 states in part that the provisions of Sections 13260(a), 13260(b), and 13263(a) may be waived by a regional board as to a specific

discharge where such discharge is not against the public interest, and that such waiver shall be conditional and may be terminated at any time by the board; and

WHEREAS, a waiver of a Report of Waste Discharge and waste discharge requirements for the Class I injection well for Northern California Power Agency would not be against the public interest because the discharge will be effectively regulated by a UIC permit issued by the EPA; and

WHEREAS, the Northern California Power Agency Commission adopted on 25 May 1994 a Final Supplemental Environmental Impact Report in compliance with the California Environmental Quality Act; and

WHEREAS, the Board reviewed the final Supplemental Environmental Impact Report and determined that the project will not have a significant impact on Water Quality, and

WHEREAS, the Board, on 28 October 1994, held a hearing in Sacramento, California, and considered all evidence concerning the matter: Therefore, be it

RESOLVED, that pursuant to Water Code Section 13269, the California Regional Water Quality Control Board, Central Valley Region, hereby waives a Report of Waste Discharge and waste discharge requirements for the Class I injection well for Northern California Power Agency which is to be regulated by EPA UIC Permit #CA194000002; and be it further

RESOLVED, that this waiver shall be conditional and may be terminated by the Board at any time.

I, WILLIAM H. CROOKS, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Quality Control Board, Central Valley Region, on 28 October 1994.

William H. Crooks

WILLIAM H. CROOKS, Executive Officer

AMENDED 23 October 1994

STATEMENT OF BASIS

CLASS I PERMIT APPLICATION

NORTHERN CALIFORNIA POWER AGENCY

UIC Permit #CA194000002

Name and Address of Applicant

General Manager
Mr. Michael W. McDonald
Northern California Power Agency
180 Cirby Way
Roseville, CA 95678-6420
Phone: (916) 781-3636

Name, Address, and Location of Facility

Northern California Power Agency
STIG Combustion Turbine Project #2
12751 North Thornton Road
Lodi, CA 95242
NE Sec 24, T3N, R5E
San Joaquin County, California

Description of Applicant's Operation

Northern California Power Agency (NCPA) is applying for an Underground Injection Control (UIC) permit to operate a Class I injection well for the disposal of a portion of waste water from its 49-MW steam injection gas turbine (STIG) project, NCPA CT-2. The wastewater will consist of treated process waste (ultrafiltration brine reject, reverse osmosis brine reject, cooling tower blowdown, and boiler blowdown) from the NCPA plant. Some of the combined wastewater will be injected into the NCPA STIG #1 well located adjacent to the generating facility at the City of Lodi White Slough Water Pollution Control Facility (WSWPCF).

The source of the incoming process water for the NCPA generating facility will be the effluent from the WSWPCF. The balance of the NCPA wastewater not injected into STIG #1 will be returned to the WSWPCF for disposal in accordance with its National Pollutant Discharge Elimination System (NPDES) permit, No. CA0079243. 98 percent of the waste water will be the brine reject from the ultrafiltration units, brine from reverse osmosis units, and blowdown from the cooling towers. The remaining 2 percent of liquid waste intended for injection will be both continuous and intermittent blowdown from the Heat Recovery Boilers.

STIG #1 is expected to operate for the 30-year anticipated lifetime of the NCPA generating plant.

Background Information

On August 15, 1990 NCPA announced plans to construct a 49-mega watt (MW) steam injected turbine project that would use reclaimed water from the WSWPCF for power augmentation, pollution control, and other process uses. The discharge from the NCPA water treatment processes and generating facilities would be concentrated and returned to the WSWPCF for disposal in evaporation ponds dedicated to the NCPA facility. In response to comments by the County of San Joaquin concerning the disposal of potentially hazardous residues from the evaporation ponds and because of space limitations at the site, NCPA added a small cooling tower to the design, increasing the discharge to approximately 183 gpm.

In May and June of 1993 NCPA drilled and tested the 4,650-ft STIG #1 well, encountering an aquifer with 14,000 mg/l total dissolved solids (TDS). Pump tests were conducted at rates up to 210 gpm, and in October of 1993 NCPA filed an application with the Environmental Protection Agency (EPA) for the operation of the STIG #1 well as a Class I injection facility.

During this period NCPA also asked the WSWPCF to accept wastewater from NCPA as a backup alternative to the injection well.

Northern California Power Agency has submitted all the required information and data necessary for a permit issuance in accordance with 40 CFR Parts 144, 146, and 147. The EPA has decided to approve this permit, pending public review and comment, and is now issuing a proposed permit.

The subject for this Statement of Basis is NCPA's STIG well #1 and its permit number is CA194000002. The permit will be issued for a period of 10 years unless the permit is terminated for reasonable cause (40 CFR 144.39, 144.40, and 144.41). The permit will be reviewed every five years.

This Statement of Basis provides the derivation and justification of the site specific permit conditions on the basis of the direct implementation regulations promulgated for the UIC program provisions of the Safe Drinking Water Act.

SITE SPECIFIC CONDITIONS

Section A - Hydrogeology of Injection and Confining Zones

Injection Formation:

Injection shall be limited to the lower Domengine Formation approximately between 4234 and 4507 feet below the ground surface.

The Primary Injection Formation, the Domengine Formation, is confined, above by 117 feet of the Nortonville Shale Formation, also called Confining Layer A and below by the Capay Shale Formation, also called Confining Layer B. The total thickness of the Capay was not reached during drilling. These intervals occur approximately between 3630 feet and 4578 feet below the ground surface (bgs).

Injection Pressure Limitation:

Injection pressure measured at the wellhead shall not exceed 975 psig for injection into the Domengine formation, based on a fracture pressure gradient of 0.73 psi per foot. The Victor Fine Foods wastewater disposal well at Lodi (VFF Deep Injection Well No. 1) was tested to incipient breakdown at a 0.73 psi/ft gradient in the Nortonville. Applying this value as a reasonable estimate of the incipient breakdown gradient at the NCPA Lodi STIG #1 site, the corresponding water injection wellhead pressure would be calculated as follows:

$$(0.73 - 0.434)\text{psi/ft} * 3{,}660 \text{ ft} = 1{,}083 \text{ psig}$$

To arrive at a reasonably conservative injection pressure limitation for NCPA well, this calculated pressure is reduced by 10 percent.

$$0.9 * 1{,}083 \text{ psig} = 975 \text{ psig}$$

The injection pressure limitations in the previous paragraph may be increased by the Director based on the results of a valid step-rate injection test in the respective proposed injection zone(s). The Director will determine any allowable increase based upon the step-rate test results and other parameters reflecting actual injection operations.

Any approval granted by the Director for the increased pressure limitations as stated in the previous paragraph shall be made part of this permit by minor modification without further opportunity for public comment.

Total Dissolved Solids (TDS) Levels of Formation Fluid:

The TDS of Domengine Sand is approximately 14,066 ppm.

Section B - Injected Fluid

Nature of Injected Fluid:

The wastewater generated by the NCPA facility consists of: ultrafiltration brine reject, reverse osmosis (RO) brine reject, cooling tower blowdown, and boiler blowdown. These four sources are combined prior to injection.

Mix Ratio of Waste Stream:

The ultrafiltration reject will constitute 48 percent of the waste stream, the RO brine reject will be 32 percent, the cooling tower blowdown will be 18 percent, and the boiler blowdown and intermittent cleaning wastes will be about 2 percent of the flow to the Wastewater Treatment System. The amount of ultrafiltration and RO brine will vary with recovery rates, and the cooling tower blowdown will vary depending on the ambient temperature and humidity. The ultrafiltration unit is projected to actually vary between 32 percent and 55 percent, the RO brine reject is expected to vary between 25 percent to 43 percent, as the cooling tower blowdown ranges between 15 percent to 32 percent. If high concentrations of silica are experienced, NCPA will be able to dilute the injectate somewhat by increasing the cooling tower blowdown rate, or by decreasing the ultrafiltration recovery rate. Boiler blowdown will usually be only about 1 percent of the flow, but could approach 43 percent for a few minutes each day.

Ultrafiltration Units Brine Wastes:

Between 180 gpm and 200 gpm of brine reject will be produced from the ultrafiltration units operating at full load. This waste stream will contain all of the solids diverted by the 0.1-micron membranes. This waste stream will serve as dilution to the other waste streams. There will be no radioactivity, heavy metals, or undesirable organic chemicals injected. All chemicals used in the waste streams have been reviewed and approved by the EPA and are within the Maximum Contaminate Levels (MCLs). The TDS of the ultrafiltration unit waste ranges from 487 ppm to 620 ppm.

Reverse Osmosis Brine Wastes:

Approximately 130 gpm of brine reject will be produced by the RO units operating at full capacity. This waste stream will contain essentially all of the dissolved solids in the filtered water routed to the RO units. Depending on the constituent, the concentrations in the RO brine will be 2.1 to 4 times the concentrations in the WSWPCF incoming water. The TDS of the RO waste ranges from 1076 ppm to 1777 ppm.

Cooling Tower Blowdown Wastes:

Approximately 73 gpm of cooling tower blowdown will be pumped to the Wastewater Treatment System from the Cooling Tower System. Due to evaporation, the concentration in the cooling tower blowdown will be approximately twice that of the makeup water coming into the Cooling Tower System. The blowdown from this system will also include residues of the sodium

hypochlorite and Nalco 7364 (5 percent sodium tolyltrazole) added to the circulating water to inhibit scale formation. The TDS of the cooling tower blowdown will range from 833 ppm to 2327 ppm.

Boiler Blowdown wastes:

To prevent buildup of dissolved solids within the Heat Recovery Boiler, a constant flow of condensate will be bled from the boiler. This flow will be vented to the atmosphere under pressure, but will result in (3 gpm) of boiler blowdown water being routed to the Waste Water Treatment System. The constituents in the boiler blowdown waste stream will consist almost entirely of water treatment chemicals. The boiler feedwater itself will have been purified by the RO and demineralizer units. The boiler blowdown will contain sodium, phosphates, morpholine, polymethacrylate, and carbohydrazide from the treatment chemicals. Elimin-ox and Nalco 352 are volatile products, and most of the carbohydrazide and morpholine will be released from vent in the blowdown tank. Less than 5 percent of these residues are expected to be in the boiler blowdown.

Section C - Well Construction

Casing and Cementing:

The conductor pipe is completed to a depth of about 30 feet, is 16 inches in diameter, and is cemented to surface. The surface casing is 10-3/4 inch diameter, and runs from the ground surface to a depth of about 611 feet. The surface casing was cemented from approximately 611 feet to the surface with approximately 340 sacks of cement. The long string casing is 7 inches in diameter and runs from the ground surface to a depth of about 3660 feet. The long string casing was cemented from 3660 feet to the surface with approximately 1274 sacks of cement. A net 222 feet of perforations were shot within the interval 4234 feet and 4573 feet for the Domengine formation.

Tubing and Packer Specifications:

Injection may take place only through 4-1/2 inch tubing with a BAKER Lok-Set PACKER set within the long string casing. The tubing and packer shall be maintained to prevent the movement of fluids into an underground source of drinking water. The tubing and packer shall be corrosion-resistant and of sufficient strength to resist wellbore pressures developed during the life of the well. The casing/tubing annulus will be filled with corrosion inhibited fluid. Injection between the outermost casing and the wellbore is prohibited.

Monitoring Devices:

The operator is required to install pressure gauges designed to provide (1) a full pressure range of 100 percent greater than the anticipated operating pressure, and (2) a certified deviation accuracy of five (5) percent or less on the tubing and the tubing/casing annulus of the well.

A flow meter will be installed for measuring flow rates and cumulative volumes. The meter will be certified for at least 95 percent accuracy throughout the range of injection rates used.

A sampling tap will be installed on the injection pump discharge line for the purpose of periodically obtaining representative samples of the injection fluid.

Section D - Corrective Action

Three deep wells have been previously drilled within one mile of the STIG #1 location. These wells penetrated the proposed injection zone. Records filed with California Division of Oil and Gas (CDOG) show that these three wells have been abandoned following CDOG procedures, and that the plugging operations were approved in every case by CDOG. Consequently, no further corrective action plan is necessary.

No corrective action for wells located within the Area of Review will be required pursuant to 40 CFR 144.55 and 40 CFR 146.7.

Section E - Well Operation

Mechanical Integrity:

Demonstrations of mechanical integrity of the injection casing, tubing and packer will be conducted within 30 days after any workovers or alterations and prior to recommencing injection. Continuation of injection operations may continue if the permittee demonstrates that the well has mechanical integrity in accordance with 40 CFR 146.8 and has received written notice from the Director that such a demonstration is satisfactory. The mechanical integrity tests (MIT) will be performed in accordance with requirements set forth by the Director.

An MIT pressure test of the annulus will also be conducted at least once every year during the life of the permit.

The construction details and cement records satisfy the requirements of 40 CFR 146.8(a)(2) for demonstrating the absence of significant fluid movement.

Injection Volume (Rate) Limitation:

The maximum injection rate shall be 200 gpm. Injection is also limited to a rate that will not cause the injection pressure at the wellhead to exceed the limits subsequent to submission of a valid step rate test data discussed above.

Injection Well Monitoring Program:

The permittee is required to sample and analyze the water quality of the injected fluids at monthly intervals. The parameters analyzed are detailed in the permit. Similar analyses shall be conducted whenever the source of the injection fluid changes. Monitoring of the injection pressure, annulus pressure, and injection flow rate must be done continuously.

Section D - Plugging and Abandonment

EPA has reviewed and approved the plugging and abandonment plan submitted by the applicant. The plugging and abandonment plan is incorporated into the permit as Attachment A. The estimated cost to plug and abandon NCPA's STIG #1 well is $18,300.

Section E - Financial Responsibility

The permittee has a bond rating within the four highest categories of Standard and Poor's (AAA, AA, A, or BB) or Moody's (Aaa, Aa, A, or Baa). EPA has identified NCPA as a financially healthy company and requires a financial credit rating statement to demonstrate financial responsibility. However, if NCPA fails the financial test, it must submit to EPA an alternative financial instrument to cover the cost of plugging and abandoning the NCPA STIG #1 well.

PUBLIC NOTICE OF INTENT TO ISSUE AN
UNDERGROUND INJECTION CONTROL (UIC) CLASS I PERMIT TO
NORTHERN CALIFORNIA POWER AGENCY (NCPA)

Purpose of Public Notice

The U.S. Environmental Protection Agency (EPA) is soliciting public comments on its proposal to issue a UIC permit to Northern California Power Agency (NCPA) authorizing the underground injection of fluids into the NCPA steam injection gas turbine STIG #1 well. The Northern California Power Agency Project is located in San Joaquin County on a 90-acre parcel in Section 24, Township 3N, Range 5E, Rio Linda, approximately 7 miles east of the Sacramento Metropolitan Airport.

Name and address of applicant:

Northern California Power Agency
11785 Socrates Mine Road
Middletown, CA 95461-663

Background

As proposed, the draft permit would allow the facility to inject treated wastewater from a steam injection gas turbine (STIG) power plant generated by the NCPA Plant. The wastewater consists of: brine reject from ultrafiltration units, reverse osmosis units, cooling tower blowdown, and boiler blowdown. The maximum injection rate shall be 200 gpm. The permit does not allow the injection of hazardous wastes.

NCPA has submitted all necessary information for the issuance of this draft permit, including details of well construction, operation, monitoring, and closure.

The EPA has made a preliminary determination to approve the permit application as provided by Part C of the Safe Drinking Water Act and attendant regulations.

Public Comments:

Both the non-proprietary information submitted by the applicant and the draft permit prepared by EPA are contained in the administrative records for the proposed injection well.
This material is available for public inspection at:

Environmental Protection Agency, Region IX
Source Water Protection Section (W-6-3)
75 Hawthorne St.
San Francisco, CA 94105
Attn: Jose L. Gutierrez
Phone: (415) 744-1829

Copies of the draft permit and the statement of basis are also available for public review at:

City of Lodi Public Library
210 West Locust Street
Lodi, CA 95240

Public comments will be accepted, in writing, at the San Francisco office until October 7, 1994. A request for a public hearing must be made in writing and should state the nature of any issues to be proposed for discussion at the hearing. A PUBLIC HEARING WILL BE HELD ONLY IF SIGNIFICANT INTEREST IS SHOWN.

Final Permit Decisions and Appeal Process

A final decision to issue, modify, or deny the permit will be made after all comments have been reviewed. Notice of the decision will then be sent to each person who has either requested such notice or has submitted written comments.

If issued, a final permit shall become effective immediately, provided that there were no comments requesting a substantial change in the draft permit, and that no substantial changes were made from the draft permit to the final permit. If substantial changes were requested or were incorporated into the final permit, the final permit will become effective thirty (30) days after issuance.

Within thirty (30) days from the date the final permit decision has been issued, any person who filed comments on the draft permit, participated in a public hearing, or took issue with any changes in the draft permit may petition the Director to review the permit decision. Persons interested in appealing the final permit decision should refer to 40 CFR Sections 124.15 to 124.20 for the procedural requirements of the appeal process.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901
Mail Code W-6-3

Mr. Bill Smith
Northern California Power Agency
P.O. Box 663
Middletown, CA 95461

Dear Mr. Smith

Enclosed please find copies of the Draft Permit, Statement of Basis, and Public Notice for the STIG #1 well. The Public Notice will be published in the Lodi News Sentinel on September 7, 1994 and the public comment period will be open for 30 days past that date.

All comments must be submitted in writing before October 7, 1994 to:

Jose L. Gutierrez
EPA Region 9 (W-6-3)
75 Hawthorne St.
San Francisco, CA 94105

If no request for a public hearing or no comments requesting significant changes to the draft permit are received, the draft permit will become effective on October 7, 1994. If either you or members of the public request significant changes to the draft permit, the comments will be addressed and a revised permit may be issued. The permit would then become effective on November 7, 1994.

If you have any questions, please call Jose L. Gutierrez at (415) 744-1829.

Sincerely,

Doris Betuel

Doris Betuel, Chief
Sourcewater Protection Section

Enclosures

Printed on Recycled Paper

NCPA A Public Agency

Northern California Power Agency
180 Cirby Way, Roseville California 95678

MICHAEL W. McDONALD
General Manager
(916)781-4255 FAX
(916)781-3636

October 13, 1993

US Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105-3901

To Whom It May Concern:

I am the chief financial officer of the Northern California Power Agency, 180 Cirby Way, Roseville, California 95678. This letter is in support of this firm's use of the financial test to demonstrate financial assurance, as specified in subpart F of 40 CFR part 144.

1. This firm is the owner or operator of the following injection wells for which financial assurance for plugging and abandonment is demonstrated through the financial test specified in subpart F of 40 CFR part 144. The current plugging and abandonment cost estimate covered by the test is shown for each injection well: $18,300;
Class I Underground Injection Control Well, located at the West side of White Slough Water Treatment Plant, 12751 North Thorton Road, Lodi, California 95242.

2. This firm guarantees, through the corporate guarantee specified in subpart F of 40 CFR part 144, the plugging and abandonment of the following injection wells owned or operated by subsidiaries of this firm. The current cost estimate for plugging and abandonment so guaranteed is shown for each injection well: .....NONE

3. In States where EPA is not administering the financial requirements of subpart F of 40 CFR part 144, this firm, as owner or operator or guarantor, is demonstrating financial assurance for the plugging and abandonment of the following injection wells through the use of a test equivalent or substantially equivalent to the financial test specified in subpart F of 40 CFR part 144. The current plugging and abandonment cost estimate covered by such a test is shown for each injection well: .
.....NONE

4. This firm is the owner or operator of the following injection wells for which financial assurance for plugging and abandonment is not demonstrated either to EPA or a State through the financial test or any other financial assurance mechanism specified in subpart F of 40 CFR part 144 or equivalent or substantially equivalent State mechanisms. The current plugging and abandonment cost estimate not covered by such financial assurance is shown for each injection well: .....NONE

This firm is not required to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on June 30. The figures for the following items marked with an asterisk are derived from this firm's independently audited, year-end financial statements for the latest completed fiscal year, ended June 30, 1993.

ALTERNATIVE II

1. (a) Current plugging and abandonment cost $18,300
   (b) Sum of the company's financial responsibilities under 40 CFR Parts 264 and 265, Subpart H, currently met using the financial test or corporate guarantee .....
   (c) Total of lines a and b $18,300
2. Current bond rating of most recent issuance of this firm and name of rating service ..... Moodys "A"
3. Date of issuance of bond ..... June 1993
4. Date of maturity of bond ..... Various
5. Tangible net worth (if any portion of the plugging and abandonment cost estimate is included in "total liabilities" on your firm's financial statements, you may add the amount of that portion to this line) ..... $10,382,000*(A)
6. Total assets in U.S. (required only if less than 90% of firm's assets are located in U.S.) ..... N/A
7. Is line 5 at least $10 million? ..... NO
8. Is line 5 at least 6 times line 1 (c)? ..... YES
9. Are at least 90% of the firm's assets located in the U.S.? If not, complete line 10.... YES
10. Is line 6 at least 6 times line 1(c)? ..... N/A

I hereby certify that the wording of this letter is identical to the wording specified in 40 CFR 144.70(f) as such regulations were constituted on the date shown immediately below.

Sincerely,

Dale B. Lain

DALE B. LAIN
Treasurer-Controller

10-13-93
Date Signed

/dsc

(A) The Agency operates on a non-for-profit basis. Therefore, any balance in Accumulated Net Revenues primarily represents differences between total revenues collected using rates based on estimated expenses and the total actual expenses incurred. In subsequent periods of operation, excess collections may be refunded to participants or appropriated for other uses at the discretion of the Agency's Commission.

Underground Injection Control Program

DRAFT PERMIT

Class I Non-Hazardous Waste Injection
Permit No. CA194000002

Well Name: NCPA - STIG #1
Lodi, California

Issued to:

Northern California Power Agency
11785 Socrates Mine Road
Middletown, CA 95461-663

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PART I. AUTHORIZATION TO INJECT

Pursuant to the Underground Injection Control regulations of the U.S. Environmental Protection Agency codified at Title 40 of the Code of Federal Regulations, Parts 124, 144, 146, 147, and 148.

Northern California Power Agency
11785 Socrates Mine Road
Middletown, CA 95461-663

is hereby authorized to engage in non- hazardous waste injection well identified as NCPA - STIG #1. The well is located in Section 24, T. 3 N., R. 5 E., in San Joaquin County, California.

Injection is authorized into the Domengine Sand Formation for the purpose of disposal of treated waste waters from a steam injection gas turbine power plant upon the express condition that the permittee meet the restrictions set forth herein.

All conditions set forth herein refer to Title 40 Parts 124, 144, 146, 147 and 148 of the Code of Federal Regulations and are regulations that are in effect on the date that this permit is effective.

This permit consists of 29 pages and includes all items listed in the Table of Contents. Further, it is based upon representations made by the permittee and on other information contained in the administrative record. It is the responsibility of the permittee to read and understand all provisions of this permit.

This permit and the authorization to inject are issued for a period of up to ten years unless terminated under the conditions set forth in Part III, Section B of this permit.

Issued this _____ day of _____

This permit shall become effective _____

_____
Harry Seraydarian, Director
Water Management Division, EPA Region 9

PART II. SPECIFIC PERMIT CONDITIONS

A. WELL CONSTRUCTION

1. Casing and Cementing The well schematic details submitted with the application are hereby incorporated into this permit as Appendix A, and shall be binding on the permittee. Notwithstanding any other provisions of this permit, the permittee shall case and cement the well to prevent the movement of fluids into or above underground sources of drinking water. The following specifications apply to the injection well:

   Surface casing - The surface casing is run and set at approximately 611 feet as an anchor for the surface pressure control equipment (BOPE). This string of casing is 10-3/4 inch O.D., K-55 steel, weighing 40.5 pounds per foot (ppf). ST & C casing cemented from the surface to a depth of 611 feet with the cement returned to surface.

   Intermediate casing - The intermediate casing is run and set at approximately 3660 feet into an impermeable shale section identified while drilling. This string of casing is 7 inch O.D., K-55 steel, weighing 20 pounds per foot (ppf). It is installed in 40 foot lengths and joined by non-upset seal locking 8-round threaded couplings. This 7 inch string is cemented from the bottom of the casing to the top with the cement returned to surface.

   Liner - The liner is hung and set from approximately 3358 feet to 4645 feet through the zone of intended injection. This string of casing is 5 inch O.D., J-55 steel, weighing 15 pounds per foot (ppf). This 5 inch liner was perforated selectively in the sands of the Domengine formation. A net 222 feet of perforations were shot within the interval 4234 and 4573 feet.

   Tubing - Injection is through a 4 1/2 inch O.D., tubing, J-55 steel, and packer.

2. Tubing and Packer Specifications Injection will take place only through the 4 1/2 inch tubing with a Baker Lok-Set Packer set within the long string casing at approximately 892 feet above the injection zone. The tubing and packers shall be maintained to prevent the movement of fluids into an underground source of drinking water. The tubing and packers shall be corrosion-resistant and of sufficient strength to resist wellbore pressures developed during the life of the well. The casing/tubing annulus will be filled with corrosion inhibited fluid. Injection between the outermost casing and the wellbore is prohibited.

3. Injection Intervals Injection into the intended zone is through perforations made through the steel casing and cement into the zone of injection by 11-gram jet charges at 4 shots per foot, 120 degrees phasing, in 3-1/8 inch hollow steel carrier guns. Perforations are 0.31 inch diameter holes per foot penetrating 18.9 inches. Injection shall be permitted for the lower Domengine Formation, between 4234 feet and 4507 feet below the ground surface. Alteration of the injection perforations and other rework operations must be properly reported (EPA Form 7520-12) and the well must demonstrate mechanical integrity before injection is authorized.

4. Monitoring Devices The operator shall install and maintain in good operating condition:

   (a) A tap on the suction line prior to the injection pump and the wellhead for the purpose of obtaining representative samples of the injection fluids;

   (b) A flow meter with measured cumulative volumes that are certified for a deviation accuracy of five (5) percent or less throughout the range of injection rates allowed by the permit; and

   (c) A pressure gauge designed to provide (1) a full pressure range of 100 percent greater than the anticipated operating pressure, and (2) a certified deviation accuracy of five (5) percent or less.

5. Proposed Changes and Workovers The permittee shall give advance notice to the Director, as soon as possible, of any planned physical alterations or additions to the permitted injection well. Any changes in the well construction will require prior approval of the EPA and a permit modification under the requirements of 40 CFR

144.39. In addition, the permittee shall provide all records of well workovers, logging, or other subsequent test data, including required mechanical integrity testing, to EPA within sixty (60) days of completion of the activity. Appendix B contains samples of the appropriate reporting forms. Demonstration of mechanical integrity shall be performed within thirty (30) days of completion of workovers or alterations and prior to resuming injection activities, in accordance with Part II, Section C.1. (a).

B. CORRECTIVE ACTION

No corrective action for wells located within the Area of Review will be required pursuant to 40 CFR 144.55 and 40 CFR 146.7.

C. WELL OPERATION

1. Prior to Commencing Injection Injection operations may not commence until the permittee has complied with items (a) and (b) as follows:

   (a) All construction and testing is complete; and

      (i) The Director has inspected or otherwise reviewed the injection well and notified the operator that it is in compliance with the conditions of the permit; or

      (ii) The permittee has received notice from the Director of his or her intent not to inspect or otherwise review the injection well; and

   (b) The permittee demonstrates that the well has mechanical integrity in accordance with 40 CFR 146.8 and has received written notice from the Director that such a demonstration is satisfactory. The permittee shall notify EPA of its intent to demonstrate mechanical integrity at least thirty (30) days prior to such demonstration.

2. Mechanical Integrity

(a) Method for Demonstrating Mechanical Integrity A demonstration of the absence of significant leaks in the casing, tubing and/or packer must be made by performing a tubing/casing annulus pressure test. This test shall be for a minimum of thirty (30) minutes at a pressure equal to the maximum allowable injection pressure. A well passes the mechanical integrity test if there is less than a five (5) percent decrease/increase in pressure over the thirty (30) minute period. Casing annuli and injection pressures must be monitored continuously and the average, maximum, and minimum daily and monthly results are included in the quarterly report to the director.

(b) Schedule for Demonstrations of Mechanical Integrity

(i) A demonstration of mechanical integrity shall be made no less frequently than every year from the effective date of this permit, in accordance with 40 CFR 146.8 and paragraph (a) above. Mechanical integrity shall also be demonstrated any time that a workover is conducted, the construction of the well is modified or when loss of mechanical integrity becomes evident during operation.

(ii) It shall be the permittee's responsibility to arrange and conduct the mechanical integrity demonstrations. The permittee shall notify the Director of its intent to demonstrate mechanical integrity at least thirty (30) days prior to each such demonstration. Results of the test shall be submitted to the Director as soon as possible but no later than sixty (60) days after the demonstration.

(iii) In addition to any demonstration made under paragraph (i) above, the Director may require a demonstration of mechanical integrity at any time during the life of the well.

(c) Loss of Mechanical Integrity If (1), the well fails to demonstrate mechanical integrity during a test, or (2), a loss of mechanical integrity becomes evident during operation, or (3), a significant change in the annulus or injection pressure occurs during normal operating conditions, the permittee shall notify the Director in accordance with Part

III, Section E.10 of this permit. Furthermore, injection activities shall be terminated immediately and operation shall not be resumed until the permittee has taken necessary actions to restore integrity to the well and EPA gives approval to recommence injection.

3. Confining Layer The injection formation is confined by a 117 foot thick marine shale accompanied by minor amounts of microlignitic siltstone of the Nortonville formation which immediately overlies the Domengine formation

4. Injection Pressure Limitation

   (a) Injection pressure measured at the wellhead shall not exceed 975 psig for injection into the Domengine formation, based on a fracture pressure gradient of 0.73 psi per foot. In no case shall injection pressure initiate fractures in the confining zone, or cause the movement of injection, or formation fluids into an underground source of drinking water (USDW).

   (b) The injection pressure limitations in paragraph (a) may be increased by the Director based on the results of a valid step-rate injection test in the respective proposed injection zone(s). The Director will determine any allowable increase based upon the step-rate test results and other parameters reflecting actual injection operations.

   (c) Any approval granted by the Director for the increased pressure limitations as stated in paragraph (b) shall be made part of this permit by minor modification without further opportunity for public comment.

5. Injection Volume (Rate) Limitation

   (a) The injection rate shall not exceed 200 gpm at any time.

   (b) The permittee may request an increase in the maximum rate allowed in paragraph (a). Any such request shall be made in writing to the Director.

   (c) Should any increase in rate be requested, the permittee shall demonstrate to the satisfaction of the Director that the increase in volume will not interfere with the operation of the facility or its ability to meet conditions described in the permit

and would not change its classification.

6. Injection Fluid Limitation

(a) The permittee shall not inject any hazardous wastes as defined by 40 CFR 261, at any time during the operation of the facility.

(b) 98% of the injection fluid shall consist of brine reject from the ultrafiltration units, reverse osmosis units and the blowdown from the cooling towers. The other 2% of the liquid wastes intended for injection will consist of both continuous and intermittent blowdown from the Heat Recovery Boilers.

(c) The injection of any fluids other than those described in paragraph (b), above, shall be reported to the Director thirty (30) days prior to the injection of the substance. Written approval by the Director is required for change of injection fluids.

7. Annulus Measurements The annulus between the tubing and the long string casing will contain approximately 449 cubic feet (3360 gallons) of treated 3 percent KCl water to prevent corrosion and bacterial growth. A minimum surface annular pressure of 100 psig shall be maintained at all times.

D. MONITORING, RECORDKEEPING, AND REPORTING OF RESULTS

1. Injection Well Monitoring Program Samples and measurements shall be representative of the monitored activity. The permittee shall utilize the applicable analytical methods described in Table I of 40 CFR 136.3, or in Appendix III of 40 CFR 261, or in certain circumstances, other methods that have been approved by the EPA Administrator. Reporting shall consist of average, maximum, and minimum daily and monthly values for injection pressure, annular pressure, flow rate, temperature and volume.

   Temperature, annular pressure, and injection pressure shall be measured at the wellhead. Injection rate/flow rate shall be measured in the supply line immediately before the wellhead.

2. Injection Fluid Monitoring Program Samples and measurements taken for the purpose of monitoring shall be

representative of the monitored activity. The method used to obtain a representative sample of the fluid to be analyzed and the procedure for analysis of the sample are as follows:

(a) Wellhead Injection Water
   (i) Grab samples shall be collected at the sampling valve at the wellhead and used for laboratory analysis for physical and chemical characteristics.

3. Injection Fluid Analysis Injection fluids shall be analyzed no less frequently than indicated for the following parameters:

Parameter	Monitoring Frequency	Sample Type
specific gravity, unitless	Quarterly	grab
conductivity, mhos	Quarterly	grab
hardness, mg/l as $CaCO_3$	Quarterly	grab
total dissolved solids, mg/l	Quarterly	grab
pH, standard units	Quarterly	grab
Arsenic	Quarterly	grab
Barium	Quarterly	grab
Boron	Quarterly	grab
Cadmium	Quarterly	grab
Calcium	Quarterly	grab
Chloride	Quarterly	grab
Chromium	Quarterly	grab
Copper	Quarterly	grab
Fluoride	Quarterly	grab
Lead	Quarterly	grab
Magnesium	Quarterly	grab
M-Alkalinity	Quarterly	grab
Mercury	Quarterly	grab
Nitrate	Quarterly	grab
Potassium	Quarterly	grab
Selenium	Quarterly	grab
Silver	Quarterly	grab
Silica	Quarterly	grab
Sodium	Quarterly	grab
Sulfate	Quarterly	grab
Vanadium	Quarterly	grab
Zinc	Quarterly	grab
Benzene	Quarterly	grab
Toluene	Quarterly	grab
Trichloroethylene	Quarterly	grab
Phenol	Quarterly	grab

4. Injection Fluid Monitoring Data

Parameter	Monitoring Frequency	Instrument
injection rate, gpm	continuous	recorder
injection total volume, gallons	continuous	totalizer
injection pressure, psig	continuous	recorder
annular pressure, psig	continuous	recorder
injection fluid temperature	continuous	recorder

5. Calibration of Monitoring Equipment All monitoring and recording equipment shall be calibrated on a regular basis. The permittee shall submit, to the Director, a report describing the calibration procedures and the frequency at which the equipment will be calibrated.

6. Automatic Alarms and Shut-Off Devices The permittee shall continuously operate and maintain an automatic warning system which will immediately notify the operators of a malfunction in the event that the injection pressure at the wellhead exceeds the maximum injection pressure authorized by this permit.

7. Monitoring Information Records of any monitoring activity required under this permit shall include:

   (a) The date, exact place, and time of sampling or field measurements;

   (b) The name of the individual(s) who performed the sampling or measurements;

   (c) The exact sampling method(s) used to take samples;

   (d) The date(s) laboratory analysis were performed;

   (e) The name of the individual(s) who performed the analyses;

   (f) The analytical techniques or methods used by laboratory personnel; and

   (g) The results of such analyses.

8. Recordkeeping

   (a) The permittee shall retain records concerning:

      (i) the nature and composition of all injected

fluids until three (3) years after the well has been plugged and abandoned.

(ii) all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation and copies of all reports required by this permit for a period of at least five (5) years from the date of the sample, measurement or report throughout the operating life of the well.

(b) The permittee shall continue to retain such records after the retention period specified in paragraphs (a) (i) and (a) (ii) unless it delivers the records to the Director or obtains written approval from the Director to discard the records.

(c) The permittee shall maintain copies (or originals) of all pertinent observation records available for inspection at the facility.

9. Reporting of Results The permittee shall submit short and accurate quarterly reports to the Director containing the following information:

(a) Results of the injection fluid analyses specified in permit condition Part II, Section D, Item 3.

(b) Average, maximum, and minimum daily and monthly values for the continuously monitored parameters specified in Part II, Section D, Item 4.

(c) Equipment calibration.

(d) A narrative description of all non-compliance that occurred during the reporting period.

Monitoring results obtained during each calendar month shall be summarized for each month and reported on EPA Form 7520-8. Forms shall be submitted for the reporting periods by the respective due dates as listed below:

Reporting Period	Report Due
Jan, Feb, Mar	Apr 28
Apr, May, June	Jul 28
July, Aug, Sept	Oct 28
Oct, Nov, Dec	Jan 28

Copies of the monitoring results and all other reports

required by this permit shall be submitted to the following addresses:

U.S. Environmental Protection Agency, Region 9
Water Management Division
Source Water Protection Section (W-6-3)
75 Hawthorne St.
San Francisco, CA 94105

E. PLUGGING AND ABANDONMENT

1. Notice of Plugging and Abandonment The permittee shall notify the Director no later than 45 days before further conversion, workover, or abandonment of the well. The Director may require that the plugging and abandonment be witnessed by an EPA representative.

2. Plugging and Abandonment Plan The permittee shall plug and abandon the well as provided in the Plugging and Abandonment Plan in Appendix C. The EPA reserves the right to change the manner in which the well will be plugged if the well is modified during its permitted life or if the well is not consistent with EPA requirements for construction or mechanical integrity. The Director may ask the permittee to estimate and to update the estimated plugging cost periodically. Such estimates shall be based upon costs which a third party would incur to plug the well according to the plan.

3. Plugging and Abandonment Report Within sixty (60) days after plugging the well, the permittee shall submit a report on Form 7520-13 to the Director. The report shall be certified as accurate by the person who performed the plugging operation and the report shall consist of either: (1) a statement that the well was plugged in accordance with the plan, or (2) where actual plugging differed from the plan, a statement specifying the different procedures followed.

4. Cessation of Injection Activities After a cessation of injection of two (2) years, the permittee shall plug and abandon the well in accordance with the Plugging and Abandonment Plan, unless it:

   (a) Provides notice to the Director; and

   (b) Has demonstrated that the well will be used in the

future, and

(c) Has described actions or procedures, satisfactory to the Director, that will be taken to ensure that the well will not endanger USDWs during the period of temporary abandonment.

F. FINANCIAL RESPONSIBILITY

1. Demonstration of Financial Responsibility The permittee is required to maintain financial responsibility and resources to close, plug, and abandon the underground injection operation as provided in the plugging and abandonment plan.

   (a) The permittee shall maintain a bond rating within the four highest categories of Standard and Poor's (AAA, AA, A, or BB) or Moody's (Aaa, Aa, A, or Baa). If the most recent bond rating does not fall within the four highest categories, then the permittee shall post a financial instrument such as a bond, letter of credit, or a trust fund to guarantee closure of the well.

   (b) The permittee must provide proof to the EPA of its bond rating or renewal every year by March 31.

2. Insolvency of Financial Institution The permittee must submit an instrument of financial responsibility acceptable to the Director within sixty (60) days after either of the following events occur:

   (a) the institution issuing the bond or financial instrument files for bankruptcy; or

   (b) the authority of the trustee institution to act as trustee, or the authority of the institution issuing the financial instrument is suspended or revoked.

PART III. GENERAL PERMIT CONDITIONS

A. EFFECT OF PERMIT

The permittee is allowed to engage in underground injection well construction in accordance with the conditions of this permit. The permittee, authorized by this permit, shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 141 or may otherwise adversely affect the health of persons. Furthermore, any underground injection activity not specifically authorized in this permit is prohibited. Compliance with this permit during its term constitutes compliance for purposes of enforcement with Part C of the Safe Drinking Water Act (SDWA). Such compliance does not constitute a defense to any action brought under Section 1431 of the SDWA, or any other common or statutory law other than Part C of the SDWA. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Nothing in this permit shall be construed to relieve the permittee of any duties under applicable regulations.

B. PERMIT ACTIONS

1. Modification, Revocation, Reissuance and Termination The Director may, for cause or upon request from the permittee, modify, revoke and reissue, or terminate this permit in accordance with 40 CFR 124.5, 144.12, 144.39, and 144.40. Also, the permit is subject to minor modifications for cause as specified in 40 CFR 144.41. The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes, or anticipated noncompliance on the part of the permittee does not stay the applicability or enforceability of any permit condition. The Director may also modify, revoke and reissue, or terminate this permit in accordance with any amendments to the SDWA if the amendments have applicability to this permit.

2. Transfer of Permits This permit is not transferable to any person except after notice is provided to the Director and the permittee complies with the requirements of 40 CFR 144.38. The Director may require modification of revocation and reissuance of the permit to change the

name of the permittee and incorporate such other requirements as may be necessary under the SDWA.

C. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

D. CONFIDENTIALITY

In accordance with 40 CFR 2 and 144.5, any information submitted to EPA pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice.

E. GENERAL DUTIES AND REQUIREMENTS

1. Duty to Comply The permittee shall comply with all applicable UIC Program regulations and conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit issued in accordance with 40 CFR 144.34. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. Such noncompliance may also be grounds for enforcement action under the Resource Conservation and Recovery Act (RCRA).

2. Penalties for Violations of Permit Conditions Any person who violates a permit requirement is subject to civil penalties, fines, and other enforcement action under the SDWA and may be subject to such actions pursuant to RCRA. Any person who willfully violates permit conditions may be subject to criminal prosecution.

3. Need to Halt or Reduce Activity not a Defense It shall not be a defense, for the permittee in an enforcement action, that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. Duty to Mitigate The permittee shall take all reasonable steps to minimize and correct any adverse impact on the environment resulting from noncompliance with this permit.

5. Proper Operation and Maintenance The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.

6. Duty to Provide Information The permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

7. Inspection and Entry The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

   (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this permit;

   (b) Have access to and copy, at reasonable times, any records that are kept under the conditions of this permit;

   (c) Inspect and photograph at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

   (d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any location.

8. Records of the Permit Application The permittee shall maintain records of all data required to complete the permit application and any supplemental information submitted for a period of five (5) years from the effective date of this permit. This period may be extended by request of the Director at any time.

9. Signatory Requirements All reports or other information requested by the Director shall be signed and certified by a responsible corporate officer or duly authorized representative according to 40 CFR 144.32.

10. Reporting of Noncompliance

(a) Anticipated Noncompliance The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(b) Compliance Schedules Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than thirty (30) days following each schedule date.

(c) Twenty-four Hour Reporting.

(i) The permittee shall report to the Director any noncompliance which may endanger health or the environment. Information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which must be reported orally within 24 hours:

(A) Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water.

(B) Any noncompliance with a permit condition, or malfunction of the injection system, which may cause fluid migration into or between underground sources of drinking water.

(ii) A written submission shall also be provided within five (5) days of the time the permittee becomes aware of the circumstances.

The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

(d) Other Noncompliance The permittee shall report all other instances of noncompliance not otherwise reported at the time monitoring reports are submitted. The reports shall contain the information listed in Part III, Section E.10.(c)(ii) of this permit.

(e) Other Information Where the permittee becomes aware that it failed to submit all relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the permittee shall submit such facts or information within two (2) weeks of the time such information becomes known.

11. Continuation of Expiring Permits

(a) Duty to Reapply If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must submit a complete application for a new permit at least 180 days before this permit expires.

(b) Permit Extensions The conditions of an expired permit may continue in force in accordance with 5 U.S.C. 558(c) until the effective date of new permit, if:

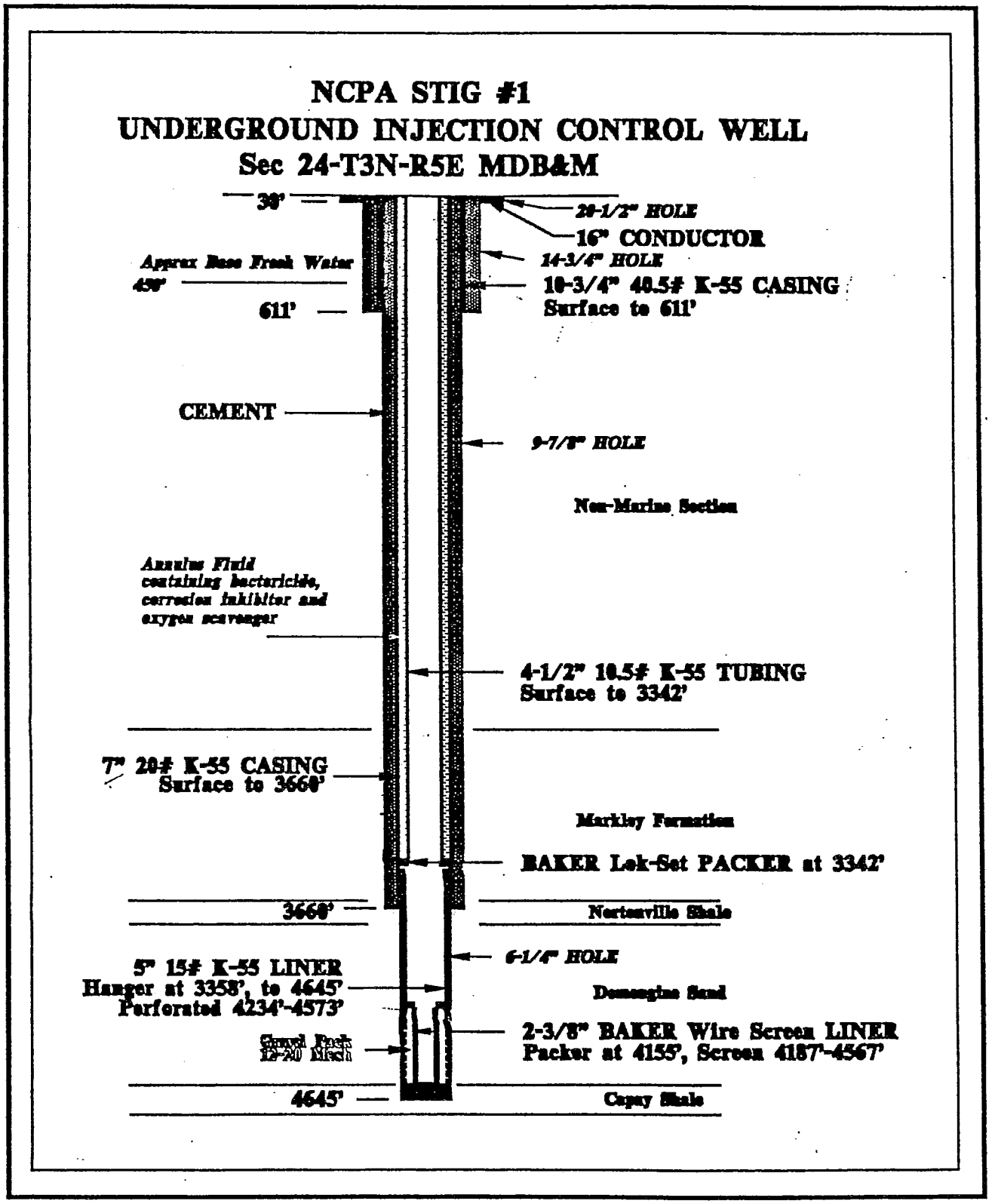
(i) The permittee has submitted a timely application which is a complete application for a new permit;

(ii) The Director, through no fault of the permittee, does not issue a new permit with an effective date on or before the expiration date of the previous permit; and

(iii) The new permit has not been denied, and if a denial has been appealed, the denial has not been upheld on appeal. (The appeal is still pending or has resulted in a reversal of the denial of the new permit application.)

APPENDIX A - WELL CONSTRUCTION PLAN

WELL CONSTRUCTION PLAN



NCPA
Northern California Power Agency

NCPA STIG#1 Injection Well
Lodi California

WELLBORE SCHEMATIC

DRAWN BY	DATE	SCALE	FIGURE
JLS	7/93	As Shown	M1-2

APPENDIX B - REPORTING FORMS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

INJECTION WELL MONITORING REPORT

Form Approved
OMB No. 2040-0042
Approval expires 9-30-91

YEAR	MONTH	-MONTH	MONTH
ection Pressure (PSI)			
1. Minimum			
2. Average			
3. Maximum			
Injection Rate (Gal/Min)			
1. Minimum			
2. Average			
3. Maximum			
Annular Pressure (PSI)			
1. Minimum			
2. Average			
3. Maximum			
Injection Volume (Gal)			
1. Monthly Total			
2. Yearly Cumulative			
emperature (F°)			
1. Minimum			
2. Average			
3. Maximum			
pH			
1. Minimum			
2. Average			
3. Maximum			
Other			

Name and Address of Permittee		Permit Number
Name and Official Title *(Please type or print)*	Signature	Date Signed

Form Approved. OMB No. 2040-0042. Expires 9-30-91

EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

APPLICATION TO TRANSFER PERMIT

NAME AND ADDRESS OF EXISTING PERMITTEE

NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES

N
W E
S

STATE | COUNTY | PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY	WELL STATUS	TYPE OF PERMIT
☐ Class I	☐ Operating	☐ Individual
☐ Class II	☐ Modification/Conversion	☐ Area
☐ Brine Disposal	☐ Proposed	Number of Wells _____
☐ Enhanced Recovery		
☐ Hydrocarbon Storage		
☐ Class III		
☐ Other		

Lease Name Well Number

NAME(S) AND ADDRESS(ES) OF NEW OWNER(S)

NAME AND ADDRESS OF NEW OPERATOR

Attach to this application a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them.

The new permittee must show evidence of financial responsibility by the submission of surety bond, or other adequate assurance, such as financial statements or other materials acceptable to the director.

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Form Approved. OMB No. 2040-0042. Expires 9-30-91

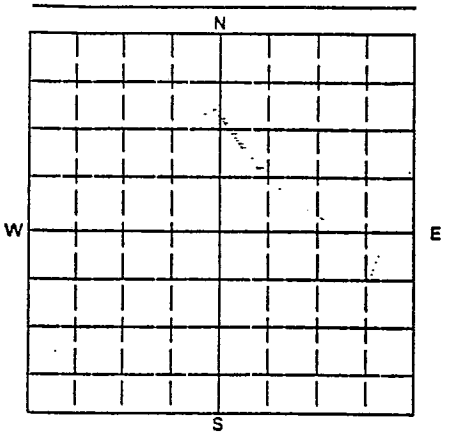
EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

ANNUAL DISPOSAL/INJECTION WELL MONITORING REPORT

NAME AND ADDRESS OF EXISTING PERMITTEE	NAME AND ADDRESS OF SURFACE OWNER

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES



STATE	COUNTY	PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

WELL ACTIVITY	TYPE OF PERMIT
☐ Brine Disposal	☐ Individual
☐ Enhanced Recovery	☐ Area
☐ Hydrocarbon Storage	Number of Wells _____

Lease Name Well Number

	INJECTION PRESSURE		TOTAL VOLUME INJECTED		TUBING — CASING ANNULUS PRESSURE (OPTIONAL MONITORING)	
MONTH YEAR	AVERAGE PSIG	MAXIMUM PSIG	BBL	MCF	MINIMUM PSIG	MAXIMUM PSIG

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Form Approved. OMB No. 2040-0042. Expires 9-30-91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

WELL REWORK RECORD

NAME AND ADDRESS OF PERMITTEE	NAME AND ADDRESS OF CONTRACTOR

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES

N
W E
S

STATE	COUNTY	PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location ____ ft. from (N/S) ____ Line of quarter section

and ____ ft. from (E/W) ____ Line of quarter section

WELL ACTIVITY		TYPE OF PERMIT
☐ Brine Disposal ☐ Enhanced Recovery ☐ Hydrocarbon Storage	Total Depth Before Rework	☐ Individual ☐ Area Number of Wells ____
	Total Depth After Rework	
Lease Name	Date Rework Commenced	Well Number
	Date Rework Completed	

WELL CASING RECORD — BEFORE REWORK

Casing		Cement		Perforations		Acid or Fracture Treatment Record
Size	Depth	Sacks	Type	From	To	

WELL CASING RECORD — AFTER REWORK *(Indicate Additions and Changes Only)*

Casing		Cement		Perforations		Acid or Fracture Treatment Record
Size	Depth	Sacks	Type	From	To	

DESCRIBE REWORK OPERATIONS IN DETAIL USE ADDITIONAL SHEETS IF NECESSARY	WIRE LINE LOGS, LIST EACH TYPE	
	Log Types	Logged Intervals

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Form Approved. OMB No. 2040-0042. Approval expires 9-30-91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

PLUGGING AND ABANDONMENT PLAN

NAME AND ADDRESS OF FACILITY	NAME AND ADDRESS OF OWNER/OPERATOR

LOCATE WELL AND OUTLINE UNIT ON SECTION PLAT — 640 ACRES

N
W E
S

STATE	COUNTY	PERMIT NUMBER

SURFACE LOCATION DESCRIPTION

¼ OF ¼ OF ¼ SECTION TOWNSHIP RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location _____ ft. from (N/S) _____ Line of quarter section

and _____ ft. from (E/W) _____ Line of quarter section

TYPE OF AUTHORIZATION

- ☐ Individual Permit
- ☐ Area Permit
- ☐ Rule

Number of Wells _____

Lease Name

WELL ACTIVITY

- ☐ CLASS I
- ☐ CLASS II
  - ☐ Brine Disposal
  - ☐ Enhanced Recovery
  - ☐ Hydrocarbon Storage
- ☐ CLASS III

Well Number

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT(LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☐ The Balance Method
- ☐ The Dump Bailer Method
- ☐ The Two-Plug Method
- ☐ Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inches)							
Depth to Bottom of Tubing or Drill Pipe (ft.)							
Sacks of Cement To Be Used (each plug)							
Slurry Volume To Be Pumped (cu. ft.)							
Calculated Top of Plug (ft.)							
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)							
Type Cement or Other Material (Class III)							

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED *(If any)*

From	To	From	To

Estimated Cost to Plug Wells

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

Form Approved. OMB No. 2040-0042
Approval expires 9-30-91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

EPA

COMPLETION FORM FOR INJECTION WELLS

ADMINISTRATIVE INFORMATION

1. Permittee

Address *(Permanent Mailing Address) (Street, City, State, and ZIP Code)*

2. Operator

Address *(Street, City, State, and ZIP Code)*

3. Facility Name | Telephone Number

Address *(Street, City, State, and ZIP Code)*

4. Surface Location Description of Injection Well(s)

State	County

¼ of	¼ of	¼ section

Township	Range
Feet from (N/S)	Line of quarter section and
Feet from (E/W)	Line of quarter section

Submit with this Completion Form the attachments listed in *Attachments for Completion Form.*

CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32).

NAME AND OFFICIAL TITLE *(Please type or print)*	SIGNATURE	DATE SIGNED

APPENDIX C - PLUGGING AND ABANDONMENT PLAN

Upon completion of injection activities the well will be abandoned according to State and Federal regulations to ensure protection of USDW sources.

The proposed plugging and abandonment plan is as follows:

1. Move in and rig up a workover/completion rig, remove the wellhead, and install and activate BOPE. Run in hole and unseat the packer at 3342 feet and pull the 4-1/2 inch Tubing string and packer out of the well.

2. After sufficient fresh water has been injected to displace all the wellbore fluids, check for fill to confirm the wellbore is open to a depth of at least 100 feet below the 5 inch Liner hanger, to about 3460 feet. If not, bail well down to that depth.

3. Run open-ended 2-3/8 inch tubing with 1200 feet of 1-1/4 inch 10 RND, EUE, N-80 tubing stringer to at least 3460 feet, but as deep as possible down to a maximum depth of 4567 feet, and cement through tubing a premium cement plug, by coordinating the pumping of cement and gradual withdrawal of tubing, until the tubing has been pulled up to depth of 3160 feet, 200 feet above the liner lap. A 280 cubic foot cement plug will be sufficient to fill the well from 4567 feet to 3160 feet with almost 100% excess.

4. Wait on cement for 12 hours, run in hole with tubing tag top of cement plug, recementing if needed until the plug is confirmed to extend a minimum of 100 feet above the liner lap.

5. Pull up to a depth of 100 feet and set a 400 cubic foot (about 100% excess) cement plug to the surface.

6. After removing the BOPE and moving off the rig, cut off the wellhead and casing at ground level and weld a steel plate at least 3/8 inch thick to cap off the 7 inch Casing.

The above plugging and abandonment plan has been reasonably estimated by NCPA to be about $18,300.

NCPA CT#2
FAX COVER SHEET

DATE: October 23, 1997

TO: Judy

FROM: Craig Bortle

SUBJECT: Waste Water Testing

NUMBER OF PAGES: 1
(INCLUDING COVER)

Currently GeoAnalytical Test for the following for NCPA-CT#2:

Specific Conductance
TDS
TSS
Arsenic
Chromium
Cadmium
Copper
Lead
Molybdenum
Nickel
Zinc

In addition to the above, I would like to get set up to have GeoAnalytical perform the following waste water tests.

Specific Gravity
Hardness, mg/l as CaCO3
PH
Barium
Boron
Calcium
Chloride
Fluoride
Magnesium
M-Alkalinity
Mercury
Nitrate
Potassium
Selenium
Silver
Silica
Sodium
Sulfate
Vanadium
Benzene
Trichloroethylene
Phenol

Please provide pricing to conduct the additional testing. If you have any further questions, please do not hesitate in contacting me.

IF YOU DO NOT RECEIVE ALL PAGES,
PLEASE CALL (209) 333-6370

representative of the monitored activity. The method used to obtain a representative sample of the fluid to be analyzed and the procedure for analysis of the sample are as follows:

(a) Wellhead Injection Water
   (i) Grab samples shall be collected at the sampling valve at the wellhead and used for laboratory analysis for physical and chemical characteristics.

3. Injection Fluid Analysis Injection fluids shall be analyzed no less frequently than indicated for the following parameters:

Parameter	Monitoring Frequency	Sample Type
specific gravity, unitless	Quarterly	grab
conductivity, mhos	Quarterly	grab
hardness, mg/l as $CaCO_3$	Quarterly	grab
total dissolved solids, mg/l	Quarterly	grab
pH, standard units	Quarterly	grab
Arsenic	Quarterly	grab
Barium	Quarterly	grab
Boron	Quarterly	grab
Cadmium	Quarterly	grab
Calcium	Quarterly	grab
Chloride	Quarterly	grab
Chromium	Quarterly	grab
Copper	Quarterly	grab
Fluoride	Quarterly	grab
Lead	Quarterly	grab
Magnesium	Quarterly	grab
M-Alkalinity	Quarterly	grab
Mercury	Quarterly	grab
Nitrate	Quarterly	grab
Potassium	Quarterly	grab
Selenium	Quarterly	grab
Silver	Quarterly	grab
Silica	Quarterly	grab
Sodium	Quarterly	grab
Sulfate	Quarterly	grab
Vanadium	Quarterly	grab
Zinc	Quarterly	grab
Benzene	Quarterly	grab
Toluene	Quarterly	grab
Trichloroethylene	Quarterly	grab
Phenol	Quarterly	grab

GeoAnalytical Laboratories, Inc.
1405 Kansas Avenue
Modesto, CA 95351
Phone (209) 572-0900
FAX (209) 572-0916

FAX TRANSMITTAL SHEET

Date 10/30/97 Number of pages transmitted (inc. this page): 2

To: Craig Bartle
NCPA

From: Judy Ungra

Concerning: Craig -
according to the ref you gave me, we determined it to be the organic "Phenols"; if you find out otherwise please let me know.
Thanks
Judy

Signed:

GEOANALYTICAL LABORATORIES, INC.
FIELD SAMPLING & ENVIRONMENTAL TESTING
1405 KANSAS AVE. PH. 209-572-0900
MODESTO, CA 95351

INVOICE

INVOICE #	INVOICE DATE
10-30-97	10/30/97

PROJECT: Price Quote for Europa

TO:
Northern California Power Agency
PO Box 1478
Davis, CA 95241-1478

TERMS	PURCHASE ORDER #
Net 30	

QTY	DESCRIPTION	UNIT PRICE	AMOUNT
1	General Minerals	160.00	160.00
1	Inorganics	160.00	160.00
1	TSS	20.00	20.00
1	502.2 (partial)	210.00	210.00
1	Phenols	195.00	195.00
1	Metals	80.00	80.00
1	Silica	20.00	20.00
		TOTAL	845.00

Thank You

DELUXE BUSINESS FORMS 1+800-328-0304

Phone: (209) 333-6370
Fax: (209) 333-6374

NCPA

Fax

To:	Karen	**From:**	Craig Bortle
Fax:		**Date:**	July 20, 2000
Phone:		**Pages:**	2
Re:	Waste Water Samples	**CC:**	

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

Comments:

Karen,

Currently we have the following items tested:

Specific Conductance
TDS
TSS
BOD
✓Arsenic
✓Chromium
✓Cadmium
✓Cooper
✓Molybdenum
✓Nickel
Zinc

In addition I would like to add the following items to our testing program:

Specific Gravity
Hardness, mg/l as CaCo3
PH
✓Barium
✓Boron
✓Calcium
✓Chloride
✓Fluoride
✓Lead
Magnesium
✓M-Alkalinity
✓Mercury
Nitrate
Potassium
Selenium
Silver
Silica
Sodium
Sulfate
Vanadium
Benzene
Trichloroethylene
Phenol

We will need chain of custody sheets as well as the necessary sample bottles.

I inventoried out stock today and found that we need Plastic Liter bottles, Amber Liter bottles, VOA's, 500 ml plastic bottles w/nitric acid, Chain of Custody sheets for metals and TTO's and labels.

Hopefully this list doesn't take up too much of your time.

If you have any questions, please give me a call.

Thanks,

Craig

APPENDIX C - PLUGGING AND ABANDONMENT PLAN

Upon completion of injection activities the well will be abandoned according to State and Federal regulations to ensure protection of USDW sources.

The proposed plugging and abandonment plan is as follows:

1. Move in and rig up a workover/completion rig, remove the wellhead, and install and activate BOPE. Run in hole and unseat the packer at 3342 feet and pull the 4-1/2 inch Tubing string and packer out of the well.

2. After sufficient fresh water has been injected to displace all the wellbore fluids, check for fill to confirm the wellbore is open to a depth of at least 100 feet below the 5 inch Liner hanger, to about 3460 feet. If not, bail well down to that depth.

3. Run open-ended 2-3/8 inch tubing with 1200 feet of 1-1/4 inch 10 RND, EUE, N-80 tubing stringer to at least 3460 feet, but as deep as possible down to a maximum depth of 4567 feet, and cement through tubing a premium cement plug, by coordinating the pumping of cement and gradual withdrawal of tubing, until the tubing has been pulled up to depth of 3160 feet, 200 feet above the liner lap. A 280 cubic foot cement plug will be sufficient to fill the well from 4567 feet to 3160 feet with almost 100% excess.

4. Wait on cement for 12 hours, run in hole with tubing tag top of cement plug, recementing if needed until the plug is confirmed to extend a minimum of 100 feet above the liner lap.

5. Pull up to a depth of 100 feet and set a 400 cubic foot (about 100% excess) cement plug to the surface.

6. After removing the BOPE and moving off the rig, cut off the wellhead and casing at ground level and weld a steel plate at least 3/8 inch thick to cap off the 7 inch Casing.

The above plugging and abandonment plan has been reasonably estimated by NCPA to be about $18,300.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

RECEIVED 11/21/05 R Blank

Randall Blank
Northern California Power Agency
P.O. Box 1478
Lodi, CA 95242-1478

Re: Administrative Review
Class I Underground Injection Control (UIC) Permit Reissuance Application

Dear Mr. Blank:

The United States Environmental Protection Agency, Region 9 (EPA) has received Northern California Power Agency's (NCPA) application to reissue the nonhazardous Class I UIC permit no. CA194000002 (Permit). Based on our review, we consider the application to be administratively complete.

We have begun the Technical Review phase of the permitting process. During this phase, additional information and clarification of previously submitted information may be requested. Once we complete our technical evaluation, we will develop a draft permit which will be issued for a 30-day period of public review.

The annual mechanical integrity testing required under the existing Permit will be postponed until the effective date of a new permit. However, under 40 C.F.R. §144.37 and 5 U.S.C. 558(c), all other Permit conditions remain in force until the effective date of a new permit.

Please call Eric Byous of my staff at (415) 972-3531 if you have any questions regarding the permitting process or this letter.

Sincerely,

David Albright
Manager, Ground Water Office

November 10, 2005

Printed on Recycled Paper

Randall Blank

From: Byous.Eric@epamail.epa.gov
Sent: Monday, November 21, 2005 2:15 PM
To: Randall Blank
Subject: clarification of 11/10/05 Class I UIC well reissuance letter language

Randall,

Per our conversation today, for clarification:

the temperature logging, tubing-casing annular pressure, and the pressure transient (pressure fall-off) tests that have been performed by NCPA on an annual basis will be postponed until the effective date of a new Permit.

However, under 40 C.F.R. §144.37 and 5 U.S.C. 558(c), all other Permit conditions remain in force until the effective date of a new permit.
Please let me know if this doesn't address your concerns, or you have any other questions.

-Eric

.....

Eric Byous
415.972.3531
fax: 415.947.3549
USEPA, Region 9
Ground Water Office (WTR-9)

75 Hawthorne St., San Francisco, CA 94105
http://www.epa.gov/region09/water/groundwater/uic.html

APPENDIX 2

NCPA – City of Lodi Documents

CITY COUNCIL

PHILLIP A. PENNINO, Mayor
JACK A. SIEGLOCK
Mayor Pro Tempore
RAY C. DAVENPORT
STEPHEN J. MANN
JOHN R. (Randy) SNIDER

CITY OF LODI

CITY HALL, 221 WEST PINE STREET
P.O. BOX 3006
LODI, CALIFORNIA 95241-1910
(209) 334-5634
FAX (209) 333-6795

THOMAS A. PETERSON
City Manager
JENNIFER M. PERRIN
City Clerk
BOB McNATT
City Attorney

NCPA
FEB 24 1993

February 23, 1993

James W. Whalen
Assistant General Manager
Northern California Power Agency
180 Cirby Way
Roseville, CA 95678

Subject: WHITE SLOUGH LEASE: NCPA COMBUSTION TURBINE PROJECT 2

Dear Jim:

Attached for your file is an original signed copy of the lease agreement between the City of Lodi and Northern California Power Agency for location of a steam injected gas turbine at White Slough Water Pollution Control Facility (STIG Project). The agreement was approved by the Lodi City Council at its regular meeting held February 17, 1993.

Sincerely,

BOB McNATT
City Attorney

enclosure

NCPA15/TXTA.01V

NCPA A Public Agency
Northern California Power Agency
180 Cirby Way, Roseville California 95678

MICHAEL W. McDONALD
General Manager
(916) 781-3636

May 7, 1993

The City of Lodi
Thomas A. Peterson, City Manager
221 West Pine Street
Lodi, California 95240

LETTER AGREEMENT

Pursuant to the Ground Lease that commenced January 1, 1993 between The City of Lodi (Landlord) and the Northern California Power Agency (Tenant), the aforementioned parties hereby agree to the deletion of paragraph 4. Rent, (A) Monthly Rent thereof and the insertion of the following paragraph:

4. Rent, (A) Annual Rent. During the remaining term of this lease, Tenant shall pay annual rent in the amount of SIXTEEN THOUSAND TWO HUNDRED FORTY-EIGHT DOLLARS ($16,248) to Landlord, in advance, on or before July 1 of each year for the following 12 months period.

This amendment shall become effective July 1, 1993.

LANDLORD:

CITY OF LODI, a municipal corporation

By Thos. A. Peterson
THOMAS A. PETERSON

Its City Manager

Date: 5/13/93

TENANT:

NORTHERN CALIFORNIA POWER AGENCY

By M W McDonald

Its Michael W. McDonald, General Manager

Date: May 7, 1993

orig! Gail
cc: AIPSharon / leases / lodi / chron

NCPA
MAY 17 1993

GROUND LEASE

by and between

THE CITY OF LODI

(Landlord)

and

NORTHERN CALIFORNIA POWER AGENCY

(Tenant)

GROUND LEASE

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GROUND LEASE

THIS LEASE, entered into this 17th day of February, 1993, by and between the CITY OF LODI, a municipal corporation ("Landlord"), and NORTHERN CALIFORNIA POWER AGENCY ("Tenant").

1. Premises. Landlord leases to Tenant and Tenant leases from Landlord that real property in the City of Lodi, County of San Joaquin, California, described in Exhibit A attached hereto and made a part hereof. The premises leased to Tenant are referred to in this Lease as the "Leased Premises" or the "Premises."

2. Use. Tenant shall have the use of the Leased premises for the purpose of the construction, operation and maintenance of a gas turbine power generation plant and incidental ancillary uses (the "Project"), and for any other lawful purpose.

3. Term; Extension. The term of this Lease shall commence on January 1, 1993 ("Commencement Date"), and shall terminate, unless earlier terminated in accordance with the provisions of this Lease, on a date fifty (50) years from the Commencement Date. Tenant's right to exclusive possession shall commence on the Commencement Date. Tenant shall have the right to extend the term of this Lease on all the terms and conditions set forth herein for an additional period of fifty (50) years, to be exercised by written notice to Landlord during the last year of the initial term of this Lease.

4. Rent.

(A) Monthly Rent. Rent payments will begin on a monthly basis on the Commencement Date. Tenant shall pay to Landlord rent on or

before the first day of each calendar month during the term of this Lease, in advance. The monthly rent shall be ONE THOUSAND THREE HUNDRED FIFTY-FOUR DOLLARS ($1,354) per month for one unit, TWO THOUSAND SEVEN HUNDRED EIGHT DOLLARS ($2,708) per month for two units.

(B) Rental Adjustments. The rent shall not be adjusted for the first ten (10) years of the term. The rent may be adjusted on January 1 of the eleventh (11th) year and each tenth (10th) year thereafter. Following an adjustment, the rent will remain fixed for ten (10) years. The adjustment shall be based on market conditions and cannot exceed twenty-five percent (25%) of the then-current rent. Tenant and Landlord may each submit information to the other establishing the market conditions then in effect and the reason for any adjustment. Tenant and Landlord shall act in good faith and cooperate with one another in establishing any adjustment.

(C) Payments. All rent to be paid by Tenant to Landlord shall be in lawful money of the United States of America and shall be paid without deduction or offset, prior notice or demand, and at such place or places as may be designated from time to time by Landlord.

5. Utilities. During the term of this Lease, Tenant agrees to pay all charges and expenses in connection with utility services and to protect Landlord and the Leased Premises from all such charges and expenses.

6. Repairs and Maintenance.

(A) At all times during the term of this Lease, Tenant shall, at its cost and expense, maintain the Leased Premises and all improvements thereon in good order and repair and safe condition, including but not limited to, fences and roadways predominantly used by Tenant. Tenant shall

keep Landlord apprised of the volume and nature of truck traffic upon the demised premises.

(B) Landlord shall not be obligated to make any changes, alterations, additions or repairs in, on or about the Leased Premises or any part hereof or any improvements installed thereon. Tenant waives all provisions of law that may impose a duty of repair on Landlord.

(C) Tenant shall indemnify and save harmless Landlord against all actions, claims and damages by reason of (1) Tenant's failure to perform the terms of this paragraph, or (2) Tenant's nonobservance or nonperformance of any law, ordinance or regulation applicable to the Leased Premises, and any liability or duty to repair imposed by the laws of California.

(D) Tenant agrees to construct a perimeter fence around the Leased Premises according to the attached specification.

7. Mechanic's Liens.

(A) Covenant Against Liens and Claims. Tenant shall not allow or permit to be enforced against the Leased Premises or any part thereof, any mechanic's, materialmen's, contractor's or subcontractor's liens arising from any claim growing out of work of any construction, repair, restoration, operation, replacement or improvement, or any other claim or demand no matter how the same may arise. Tenant shall pay or cause to be paid all of said liens, claims or demands before any lawsuit is brought to enforce them against the Leased Premises. Tenant agrees to indemnify and hold the Landlord and the Leased Premises free and harmless from all liability for any and all such liens, claims and demands, together with reasonable attorneys' fees and all costs and expenses incurred by Landlord in connection therewith.

(B) Tenant's Right to Contest Liens. Notwithstanding anything to the contrary set forth above, if Tenant shall in good faith contest the validity of any such lien, claim or demand, then Tenant shall, at its expense, defend itself and Landlord against the same and shall pay and satisfy any adverse judgment that may be rendered thereon before the enforcement thereof against Landlord or the Leased Premises.

(C) Landlord Paying Claims. In the event Tenant shall fail to pay and discharge or cause to be paid and discharged, when due and payable, any tax, assessment or other charge upon or in connection with the Leased Premises, or any lien or claim for labor or material employed or used or any claim for damages arising out of the construction, repair, restoration, replacement, maintenance and use of the Leased Premises and any improvements thereon, or any judgment on any contested lien or claim, or any insurance premium or expense in connection with the Leased Premises and improvements, or any other claim, charge or demand which Tenant has agreed to pay or cause to be paid under the terms of this Lease, and if Tenant, after ten (10) business days' written notice from Landlord to do so shall fail to pay and discharge the same, or in the event Tenant contests such tax, assessment, claim or charge then Landlord may, at his option, pay any such tax, assessment, insurance expense, lien, claim, charge or demand, or settle or discharge any action therefor, or judgment thereon, and all costs, expenses and other sums incurred or paid by Landlord in connection with any of the foregoing shall be paid by Tenant to Landlord upon demand, together with interest thereon at Bank of America's prime rate from the date incurred or

paid. Any default in such repayment by Tenant shall constitute a breach of the covenants and conditions of this Lease.

8. Insurance and Indemnity.

(A) Landlord's Nonliability. Landlord shall not be liable for any loss, damage or injury of any kind to any person or property arising from any use of the Leased Premises, or any part thereof, or caused by any defect in any building, structure or other improvement thereon or in any equipment or other facility therein, or caused by or arising from any act or omission of Tenant or any of its agents, employees, licensees or invitees, or by or from any accident on the Leased Premises or any fire or other casualty thereon, or occasioned by the failure of Tenant to maintain the Leased Premises and all improvements thereto in a safe condition, or arising from any other cause except where caused by the negligence of Landlord, its agents or employees.

(B) Indemnification of Landlord. Notwithstanding anything to the contrary contained in this Lease, and irrespective of any insurance carried by Tenant for the benefit of Landlord under the terms of this Lease, Tenant agrees to protect, indemnity and hold the Landlord and the Leased Premises harmless from any and all damages and liabilities at any time occasioned by or arising out of (1) any act, activity or omission of Tenant, or of anyone holding under Tenant, or (2) the occupancy or use of the Leased Premises or any part thereof, by or under Tenant, or (3) any state or condition of the Leased Premises or any part thereof.

(C) Liability Insurance. Tenant shall procure and maintain at all times during the term of this Lease, at its sole cost and expense, a policy or policies of commercial public liability insurance by the terms of which

Landlord and Tenant are named as insured and are indemnified against liability for damage or injury to property or person, including death, of any person entering upon or using the Leased Premises or any improvements thereon or any part thereof, with a combined single limit for bodily injury and property damage in an amount of not less than ONE MILLION DOLLARS ($1,000,000). Such public liability insurance policy or policies shall be stated to be primary and noncontributing with any insurance which may be carried by Landlord and shall contain a provision (provided such provisions are available without increased premium) that the Landlord, although named as an insured shall nevertheless be entitled to recover under that policy for any loss, injury or damage to the Landlord, its agents and employees or the property of such persons by reason of the negligence of Tenant. Tenant may at its option self-insure upon the foregoing terms.

(D) Certificate of Insurance. All policies of insurance procured and maintained by Tenant hereunder shall be issued by companies having not less than Best's A: Class X rating and shall be issued in the name of the Landlord and Tenant for the mutual and joint benefit and protection of the parties. Executed copies of all insurance policies or a certificate thereof shall contain a provision that not less than thirty (30) days' written notice shall be given to Landlord prior to the cancellation, reduction of coverage, expiration or any material change in any such policy.

(E) Failure to Provide Insurance. If Tenant fails or refuses to procure or to maintain insurance as required by this Lease or fails or refuses to furnish Landlord with required proof that the insurance has been procured and is in force and paid for, Landlord shall have the right at Landlord's

election, upon ten (10) days advance written notice, to procure and maintain such insurance. The premiums paid by Landlord shall be treated as added rent due from Tenant with interest at the Bank of America prime rate, to be paid within thirty (30) days of demand. Landlord shall give prompt notice of the payments of such premiums, stating the amounts paid and the names of the insurer or insurers.

(F) Waiver of Subrogation. The parties hereby release each other, and their respective representatives, from any claims for damage to any person or to the Premises and the improvements which may be located upon the Premises and to the fixtures, personal property, tenant's improvements and alterations of tenant in or on the Premises and the improvements which may be located upon the Premises that are caused by or result from risks insured against under any insurance policies carried by the parties hereto and in force at the time of any such damage. Each party hereto shall cause each insurance policy obtained by it to provide that the insurance company waives all right of recovery by way of subrogation against either party in connection with any damage covered by any policy, provided obtaining such a waiver in each such policy is then available at a reasonable charge. Neither party hereto shall be liable to the other for any damage caused by fire or any of the risks insured against under any insurance policy required by this Lease.

9. Landlord's Covenants.

(A) Water Supply. Landlord shall make available to Tenant a minimum of 550,000 gallons per day of reclaimed water from the White Slough Treatment Plant.

Aug 02 05 09:14p p.14

(B) Discharge of Water. Landlord shall upon payment by Tenant of applicable connection fees, accept Tenant's domestic wastewater from the project into the White Slough Water Pollution Control Facility or other suitable treatment plant.

10. Repair and Restoration. If during the term of this Lease any building or improvement on the Leased Premises or any part thereof shall be damaged or destroyed by fire or other casualty, Tenant may, at its sole cost and expense, repair or restore the same or may elect not to repair or restore. If Tenant elects not to repair or restore, this Lease shall terminate. Tenant waives the provisions of Civil Code Sections 1932(2) and 1933(4) with respect to any destruction of the Premises. Any monies received by Landlord as compensation for damage or loss to improvements installed by Tenant on the Premises shall be paid to Tenant and are hereby assigned to Tenant.

11. Assignment and Subletting. Tenant may not encumber, assign, sublease or otherwise transfer this Lease, or any right or interest hereunder, or in or to any of the improvements constructed or installed on the Leased Premises, in whole or in part, without the prior written consent of Landlord. Such consent shall not be withheld unreasonably.

12. Default. The occurrence of any one or more of the following events shall constitute a default under this Lease by Tenant:

(A) Failure to pay an installment of rent or other sum;

(B) Failure to pay any insurance premium, lien, claim, demand, judgment or other charge provided for in this Lease to be paid or caused to be paid by Tenant at the time and in the manner as provided in this Lease;

(C) Failure to maintain the Leased Premises or cause the same to be maintained as provided for in this Lease;

(D) Abandonment of the Leased Premises after completion of construction for a continuous period of one hundred twenty (120) days; or

(E) Failure to perform or breach of any other covenant, condition or restriction provided for in this Lease.

13. Remedies in Event of Default. Upon any default of Tenant, and in the event the said default is due to the failure of Tenant to make the payment of any installment of rent or other sum when due, and in the event Tenant shall fail to remedy such default within ten (10) days after written notice to do so, or upon any other default by Tenant, and in the event that Tenant shall fail to remedy such other default within thirty (30) days after written notice from Landlord so to do specifying the nature of such default, or if such default cannot be cured within thirty (30) days, Tenant has not commenced corrective action and prosecuted the same to completion with due diligence, or in the event that the default is of such a nature that it cannot be cured by any action of Tenant, then and in any of these events, in addition to any other remedy Landlord may have by operation of law, Landlord shall have the right but not the obligation without any further demand or notice to reenter the Leased Premises and eject all persons from the Leased Premises, using due process of law, and immediately terminate Tenant's right to possession of the Premises, and repossess the same by summary proceedings or other appropriate action, and Landlord shall thereupon be entitled to receive from Tenant all damages allowed by law.

Aug 02 05 09:14p p.16

14. Estoppel Certificates. Landlord and Tenant shall, respectively, at any time and from time to time upon not less than ten (10) days' prior written request by the other, deliver to the requesting party an executed and acknowledged statement in writing certifying:

(A) That this Lease is unmodified and in full force and effect (or if there has been any modification(s) thereof that the same is in full force and effect as modified, and stating the nature of the modification or modifications);

(B) That to its knowledge the requesting party is not in default under this Lease (or if any such default exists, the specific nature and extent thereof);

(C) The date to which rent and other charges have been paid in advance, if any; and

(D) Such other information pertaining to this Lease as may reasonably be requested.

Each certificate delivered pursuant to this paragraph may be relied on by any prospective purchaser or transferee of the Leased Premises or of Landlord's or Tenant's interest hereunder or by any fee mortgagee of the Leased Premises or of Landlord's or Tenant's interest hereunder or by any assignee of any such mortgagee.

15. Ownership of Improvements. Title to any buildings, improvements or fixtures which may be placed on the Premises by Tenant shall remain in Tenant. Landlord agrees to subordinate all rights, if any, which Landlord may have in any of such improvements to the rights of Tenant. Tenant may remove the improvements at any time during the term

of this Lease. Any improvements remaining on the Premises after expiration or sooner termination of the Lease shall become the property of Landlord.

16. Miscellaneous.

(A) Attorneys' Fees. In the event any action is brought by Landlord to recover any rent due and unpaid hereunder or to recover possession of the Leased Premises, or in the event any action is brought by Landlord or Tenant against the other to enforce or for the breach of any of the terms, covenants or conditions contained in this Lease, the prevailing party shall be entitled to recover reasonable attorneys' fees to be fixed by the Court, together with costs of suit therein incurred.

(B) Waiver. No waiver of any breach of any of the terms, covenants, agreements, restrictions or conditions of this Lease shall be construed as a waiver of any succeeding breach of the same or other covenants, agreements, restrictions and conditions hereof. No delay or omission of Landlord to exercise any right or remedy shall be construed as a waiver of any such right or remedy or of any default by Tenant under this Lease. The various rights and remedies reserved to Landlord herein including those not specifically described in this Lease shall be cumulative and, except as otherwise provided by California statutory law in force at the time of execution of this Lease, Landlord may pursue any or all of such rights and remedies whether at the same time or otherwise.

(C) Holding Over. If Tenant shall hold over the Leased Premises after the expiration of the term hereof with the consent of Landlord, either express or implied, such holding over shall be construed to be only a tenancy from month to month, subject to all the covenants, conditions and

obligations hereof, and Tenant hereby agrees to pay to Landlord the same rental as provided in this Lease; provided, however, that nothing herein contained shall be construed to give Tenant any rights to so hold over and to continue in possession of the Leased Premises after the expiration of the term hereof.

(D) Surrender at End of Term. Upon the end of the term of this Lease, as provided herein, or any extension thereof, or sooner termination of this Lease, Tenant shall surrender to Landlord all and singular the Leased Premises, together with all improvements as hereinabove provided, and all fixtures and equipment. Upon surrender of the Premises, Tenant shall, if directed by the Public Works Director, remove at its own expense any and all equipment remaining thereon.

(E) Lease Binding Upon Successors and Assigns. Subject to the limitations on assignment and subleasing, each of the terms, covenants and conditions of this Lease shall extend to and be binding on and inure to the benefit of not only Landlord and Tenant, but each of their successors and assigns. Whenever in this Lease reference is made to either Landlord or Tenant, the reference shall be deemed to include, wherever applicable, the successors and assigns and such parties the same as if in every case expressed.

(F) Inspection. Landlord reserves the right for Landlord and Landlord's agents and representatives to enter upon the Leased Premises at any reasonable time for the purpose of attending to Landlord's interest hereunder, and to inspect the Leased Premises.

(G) Relationship of Parties. The relationship of the parties hereto is that of Landlord and Tenant, and it is expressly understood and and

agreed that Landlord does not in any way nor for any purpose become a partner of Tenant or a joint venturer with Tenant in the conduct of Tenant's business or otherwise, except as provided by the Phase 2 and Phase 3 combustion turbine project number 2 agreements.

(H) Time of the Essence. Time is expressly declared to be of the essence of this Lease.

(I) Memorandum of Lease. This Lease shall not be recorded, but the parties agree to execute and deliver a Memorandum of this Lease in recordable form, which Memorandum shall be recorded.

(J) Quitclaim. At the expiration or earlier termination of this Lease, Tenant shall execute, acknowledge and deliver to Landlord within five (5) days after written demand from Landlord to Tenant any quitclaim deed or other document required by any reputable title company to remove the cloud of this Lease from the real property subject to this Lease.

(K) Number and Gender. Whenever the singular number is used in this Lease and when required by the context, the same shall include the plural, and the masculine gender shall include the feminine and neuter genders, and the word "person" shall include corporation, firm or association. If there is more than one Tenant, the obligations imposed under this Lease upon Tenant shall be joint and several.

(L) Headings and Titles. The marginal headings or titles to the paragraphs of this Lease are not a part of this Lease and shall have no effect upon the construction or interpretation of any part of this Lease.

(M) Entire Agreement. This Lease contains the entire agreement of the parties hereto with respect to the matters covered hereby,

and no other previous agreement, statement or promise made by any party hereto which is not contained herein shall be binding or valid.

(N) Force Majeure. Except as to the payment of rent, neither of the parties hereto shall be chargeable with, liable for, or responsible to, the other for anything or in any amount for any delay caused by fire, earthquake, explosion, flood, hurricane, the elements, acts of God, or the public enemy, action or interference of governmental authorities or agents, war, invasion, insurrection, rebellion, riots, strikes, or lockouts or any other cause whether similar or dissimilar to the foregoing, which is beyond the control of such parties and any delay due to said causes or any of them shall not be deemed a breach of or default in the performances of this Lease.

(O) Disclaimer of Representation. Except as otherwise specifically provided herein, Landlord has made no representations or warranties to the Tenant concerning the Leased Premises, the present use thereof or the suitability for Tenant's intended use of the property. The foregoing disclaimer includes, without limitation, topography, climate, air, water, water rights, utilities, present and future zoning, soil, subsoil, drainage, access to public roads, proposed routes of roads, or extension thereof, or effect of any state or federal environmental protection laws or regulations. Tenant represents and warrants to Landlord that he and his representatives have made or will make their own independent inspection and investigation of the Leased Premises and Tenant, in entering into this Lease, is relying solely on such inspection and investigation. No patent or latent physical condition of Leased Premises, whether or not known or discovered, shall affect the rights of either party hereto. Any agreement, warranties or representations

Aug 02 05 09:16p p.21

not expressly contained herein shall in no way bind either Tenant or Landlord. Landlord and Tenant waive any right or rescission and all claims for damages by reason of any statement, representations, warranty, promise and agreement, if any, not contained in this Lease.

(P) Quiet Enjoyment. This Lease is subject and junior only to all existing easements, covenants, conditions and restrictions and other matters and encumbrances of record as of the date of this Lease. As long as Tenant is not in default of any provision of this Lease, Tenant shall have quiet enjoyment of the premises.

(Q) Termination. Tenant may terminate this Lease at any time upon six (6) months advance notice.

17. Payments and Notices. Any notice to be given or other document to be delivered by either party to the other party may be given by personal delivery or may be deposited in the United States mail in the State of California, duly registered or certified, with postage prepaid, and addressed to the party for whom intended as follows:

To Landlord:	Thomas A. Peterson City Manager 221 West Pine Street Lodi, CA 95240
To Tenant:	Northern California Power Agency Attn: Assistant General Manager 180 Cirby Way Roseville, CA 95678

Either party hereto may from time to time by written notice to the other party designate a different address which shall be substituted for the one specified above. If any notice or other document is sent by registered or

certified mail, as provided above, the same shall be deemed served or delivered seventy-two (72) hours after the mailing thereof.

18. Right of First Refusal. Landlord shall not at any time during the term of this lease sell or convey or agree to sell or convey all or any portion of the Leased Premises without first having complied with the requirements of this Paragraph. If landlord shall desire to sell or convey all or any portion or portions of the Leased Premises, Landlord shall obtain from a third party a bona fide arms' length offer (the "Offer") and Landlord shall submit a written copy of the Offer to Tenant and shall give Tenant forty-five (45) days within which to elect to meet the Offer. If Tenant elects to meet the Offer, Tenant shall give Landlord written notice thereof and closing shall be held within forty-five (45) days thereafter, whereupon Landlord shall convey to Tenant all or any portion of the Leased Premises which are the subject of the Offer. At closing, Landlord shall deliver to Tenant a grant deed, sufficient to convey to Tenant fee simple title to the Premises free and clear of all liens, restrictions and encumbrances. Landlord shall pay all transfer taxes in connection with such conveyance. This right of first refusal shall continue as to any and all portions of the Leased Premises. In the event Tenant shall elect not to met any Offer, Landlord may thereafter sell the portion or portions of the Leased Premises which are the subject of the Offer only to the party who made the Offer and only strictly in accordance with the terms thereof. To prevent Landlord from defeating the rights of Tenant hereunder, Landlord agrees that Landlord will at no time accept an offer to purchase all or any portion of the Leased Premises together with any other property of Landlord in contravention of Tenant's right to purchase the Premises.

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19. Abandonment and Closure of Injection Wells. Upon termination of this lease, Tenant, at its sole expense, shall provide for the abandonment and closure of any and all injection wells utilized on site by Tenant. Such abandonment shall be done in compliance with all applicable state and federal laws and regulations and under the direction of the California Department of Oil and Gas.

This Ground Lease has been executed on the date first set forth, to become effective as provided for in paragraph 3 hereof.

LANDLORD:

CITY OF LODI, a municipal corporation

By Thos. A. Peterson
THOMAS A. PETERSON
Its City Manager
Date: 2/22/93

TENANT:

NORTHERN CALIFORNIA POWER AGENCY

By James W. Whalen
Its Assist Gen Mgr.
Date: January 29, 1993

ATTEST:

Jennifer M. Perrin
JENNIFER M. PERRIN
City Clerk

Approved As To Form:

BW McNatt
BOBBY W. McNATT
City Attorney

Aug 02 05 09:17p p.24

916 781-4255

DESCRIPTION FOR LAND LEASE PURPOSES

A portion of the southeast quarter of Section 23 and the southwest quarter of Section 24, Township 3 North, Range 5 East, Mount Diablo Base and Meridian, being more particularly described as follows:

> COMMENCING at the southwest corner of said Section 24; thence South 89°48'30" East along the south line of said Section 24, a distance of 154.09 feet, more or less, to a point on the east line of that strip of land granted as an easement to the Pacific Gas and Electric Company described in Deed dated September, 6, 1957, in Book 2013 of Official Records at Page 426, San Joaquin County Records and the POINT OF BEGINNING of this description; thence North 23°56' West along said east line, a distance of 533.43 feet; thence North 68°39'30" East, parallel with and 20.00 feet south of the center of the south levee of the White Slough Water Pollution Control Plant Skimming Ponds, a distance of 676.34 feet; thence South 20°58" East, a distance of 788.22 feet to the south line of said Section 24; thence North 89°48'30" West along said south line, a distance of 695.61 feet, more or less, to the point of beginning.

Contains 10.0 acres, more or less.

Also, the centerline of a 20.00 foot wide easement being more particularly described as follows:

> COMMENCING at the southwest corner of said Section 24; thence South 89°48'30" East along the south line of said section, a distance of 849.70 feet; thence North 20°58" West, a distance of 46.35 feet to a point on the center of a dirt access road and the POINT OF BEGINNING of this description, said point bears North 89°10'11" East, a distance of 28.66 feet from a monitoring well located in the southeast corner of above described land; thence South 89°46'53" East, a distance of 411.14 feet; thence along the arc of a curve concave to the north having a radius of 100.00 feet through a central angle of 46°26'20", a distance of 81.05 feet; thence

North 43°46'47 East, a distance of 299.82 feet; thence along the arc of a curve concave to the west having a radius of 125.00 feet through a central angle 64°13'48", a distance of 140.13 feet; thence North 20°27'01" West, a distance of 472.34 feet, more or less, to the center of the paved entrance road to the White Slough Water Pollution Control Plant.

Contains .65 acres, more or less.

LICENSED LAND SURVEYOR
GEORGE HARCROW
No. 6494
EXPIRES 6-30-95
STATE OF CALIFORNIA

11-21-91

George Harcrow, L.S. 6494
License Expires 6/30/95

Date

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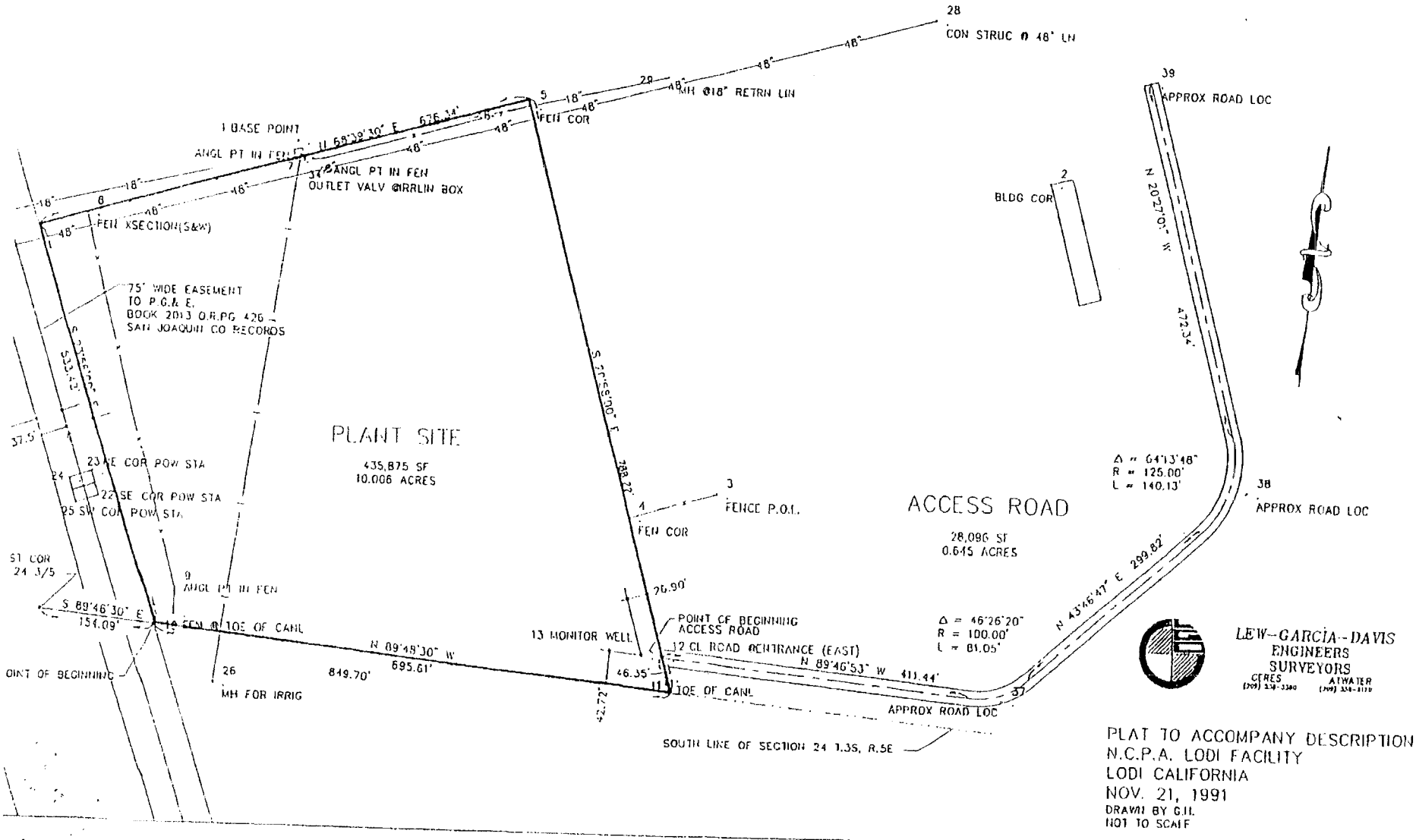


PLAT TO ACCOMPANY DESCRIPTION
N.C.P.A. LODI FACILITY
LODI CALIFORNIA
NOV. 21, 1991
DRAWN BY G.H.
NOT TO SCALE

room should be immediately adjacent to the boiler with a glass window (6 ft wide x 3 ft high). The operator should be able to view the unit simply by looking up from the control board. The Owner will require space for five 36 inch wide control panels at Ceres and *three* 36 inch wide control panel*s (1-SCADA panel, 1-C/R panel, and 1- spare)* at Lodi. Phone system should include yard public address capability; Electrical Room (30 ft x 40 ft minimum dimensions) which will contain electrical switchgear, motor control centers, etc.; and the Turbine Area (Ceres Only) to house the turbine enclosure and the generator. All offices, lunch room, testing lab, electrical room, and tech shop shall be finished with vinyl floors, painted gypsum board walls and suspended acoustical ceilings. The restrooms and locker facilities shall be finished with ceramic floor tile, ceramic wall tile, and water resistant gypsum board ceilings. The lab countertop shall be black slate or stainless steel. All room finishes shall be in accordance with AIA standards and subject to approval by the Owner. All other areas not requiring finished surfaces shall have acoustical metal liner panel covering the insulation and building support steel. Acoustical insulation shall be used to prevent noise transmission to other areas.

3. Warehouse (30 ft x 60 ft minimum dimensions) for spare parts for the facility shall be included.

All pre-engineered buildings proposed shall be Star or Varco Pruden.

3.8.7 Site Fencing

The entire site shall be fenced with a eight foot high fence complete with extension arms with three rows of two-strand barbed wire projecting at an angle of approximately 45 deg extending outward. The fencing material shall be vinyl coated No. 9 gage good quality steel wire. The fabric shall have a uniform diamond mesh approximately 2 in between the parallel sides. Top and bottom selvages shall have a twisted and barbed finish.

The Contractor shall provide at the main entrance a motor-operated gate. The Contractor shall also provide an intercom system from the main gate to the control room and allow for remote operation of the main gate from the control room.

Fence posts, gates, and accessories, such as barbed and tension wire, ties, bands, clips, stretcher bars, post tops, post braces, and gate hinges, latches, stops, and keepers shall be in

accordance with Industrial Steel Specifications for Fence-Posts, Gates, and Accessories of the Chain Link Fence Manufacturers Institute except as follows:

Intermediate posts shall be Type I or Type II round pipe.

Posts shall have holes suitable for the through passage of a top fence rail.

Bottom reinforcing wire shall be No. 7 gage galvanized steel wire.

Double gates shall have eccentric double locking type latches which engage strikes securely bolted to the gate frames at both top and bottom, and also engage a heavy malleable iron nonfreezing gate stop anchored in a concrete footing at the center of the double gate opening. Latches shall be readily locked with a padlock.

Hinges for swing gates shall allow gates to swing back parallel to the fence.

3.8.8 Site Grading

The entire site shall be graded to maintain it at an elevation above the 100 year flood level. The current elevation of the Lodi site is 5-7 feet above sea level. The 100 year flood level is 8 feet above sea level. The Contractor is required to spoil all topsoil at the site, however, no fill material is available at the site. At Ceres (Turlock), the site is above the 100 year flood level, however, the adjacent land to the west of the site cannot be used as a spoil/borrow area.

The entire site shall be paved with a minimum of 2 inches of asphalt in the non-road areas.

Roadways on the site shall be designed in accordance with CALTRANS standards and guidelines.

The storm runoff from the site shall be collected, processed in an oil-water separator, and stored in a detention pond capable of holding a ten year storm.

The Contractor shall supply alternate pricing in its proposal for installing a gravel road from Crows Foot Landing to the project site. The easement is 20 feet wide and the length of the road will be 2306 feet. The Contractor shall assume two inches of roadway gravel upon a prepared base.

At the Lodi site, for the purposes of the proposal, the Contractor is to assume the site requires three feet of fill over the entire site above the current grade. In addition to the three feet of fill, the Contractor shall determine how much

CITY COUNCIL
JOANNE MOUNCE, Mayor
LARRY D. HANSON,
Mayor Pro Tempore
SUSAN HITCHCOCK
BOB JOHNSON
PHIL KATZAKIAN

CITY OF LODI

PUBLIC WORKS DEPARTMENT

MUNICIPAL SERVICE CENTER
1331 SOUTH HAM LANE
P.O. BOX 3006
LODI, CALIFORNIA 95241-1910
Tel. (209) 333-6740 FAX (209) 333-6741
EMAIL: pwdept@lodi.gov
http:\\www.lodi.gov

BLAIR KING
City Manager
RANDI JOHL
City Clerk
D. STEPHEN SCHWABAUER
City Attorney
RICHARD C. PRIMA, JR.
Public Works Director

February 26, 2008

Northern California Power Agency CT-2
Attention: Mr. Joe Bittner
P.O. Box 1478
Lodi, Ca 95241

SUBJECT: Approval of 2008-2010 Wastewater Discharge Permit

Enclosed please find a copy of an approved Wastewater Discharge Permit. This permit will be valid through February 28, 2010. Please make note of special conditions on page four.

Your firm will need to apply for renewal on or before December 28, 2009.

Thank you for your cooperation. If you have any questions, please contact Mr. Brian Bock or Mr. Brian Longpre at (209) 333-6749.

Sincerely,

Del Kerlin
Wastewater Treatment Superintendent

DK/mf

Enclosure

cc: Michael Schafer, Laboratory Services Supervisor

CITY OF LODI
WASTEWATER DISCHARGE PERMIT

NUMBER 420

In accordance with the provisions of the City of Lodi Municipal Code, Chapter 13.12,

Name: Northern California Power Agency CT-2

Location: 12745 North Thornton Road
Lodi, CA 95242

has submitted a wastewater discharge permit application and is hereby authorized to discharge industrial wastewater from the above identified facility into the City of Lodi White Slough Water Pollution Control Facility in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in this permit.

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any significant changes effecting wastewater discharge quantity or strength must be reported in advance of discharging and written approval by the City received.

This permit shall not be assigned, transferred or sold to a new owner, new user, different premises or new or changed operation without prior written approval of the Public Works Director.

This permit shall become effective on February 29, 2008,

and shall expire at midnight on February 28, 2010.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application must be filed 60 days before the expiration date for reissuance of this permit in accordance with the requirements of City of Lodi Municipal Code, Chapter 13.12.

Renewal must be applied for on or before December 28, 2009.

Del Kerlin

for Richard C. Prima, Jr.
Public Works Director

Issued this 5th day of Mar., 2008

420NCPA

PART 1 - EFFLUENT LIMITATIONS

A. During the duration of this permit the discharge from the outfall(s) indicated in Section 3.I of the permit application, Building Layout, shall not exceed the following effluent limitations. In addition, the discharge shall comply with all other applicable regulations and standards contained in City of Lodi Municipal Code, Chapter 13.12.

EFFLUENT LIMITATIONS
Outfall(s) to WSWPCF (See Appendix A).

Parameter	Daily maximum (mg/L)
Arsenic	2.5[1]
Cadmium	0.5[1]
Chromium, total	29.[1]
Copper	3.0[1]
Cyanide, total	1.4[1]
Lead	4.0[1]
Mercury	0.8[1]
Nickel	13.[1]
Silver	2.9[1]
Zinc	3.5[1]

Discharges containing concentrations of tetrachloroethylene (PCE) or trichloroethylene (TCE) exceeding five micrograms per liter for any grab sample are prohibited.[1]

1. Lodi Municipal Code, Chapter 13.12.030.

The pH shall not be less than 6.5 standard units nor greater than 8.5 standard units.

PART 2 - MONITORING REQUIREMENTS

A. While this permit is in effect the permittee shall monitor outfall(s) to WSWPCF (See Appendix A) for the following.

Parameter	Sample Location	Measurement Frequency	Sample Type
Flow	Influent from clarifiers	Daily	Continuous
Flow	Effluent to City*****	Daily	Continuous
pH	Effluent to City*****	Daily	Continuous
Temperature	Effluent to City*****	Daily	Continuous
Conductivity	Effluent to City*****	Daily	Continuous
BOD	Effluent to City*****	Quarterly	24 hour composite****
Suspended Solids	Effluent to City*****	Quarterly	24 hour composite****
TDS*	Effluent to City*****	Quarterly	24 hour composite****
Metals**	Effluent to City*****	Yearly	24 hour composite****
TTO's***	Effluent to City*****	Yearly	Grab

* TDS to be total dissolved solids at 180° C.

** Metals to include arsenic, cadmium, copper, chromium, lead, molybdenum, nickel, zinc and mercury.

*** TTO's to be total toxic organics by EPA methods 624 and 625.

**** A Grab sample may be taken in lieu of a composite sample as long as the wastewater tank has not been discharged 24 hours prior to sampling.

*****effluent to WSWPCF (See Appendix A).

(Continued on next page)

MONITORING REQUIREMENTS (Continued)

B. The City must be notified and re-sampling is required within 24 hours of noticing any slug load, spill or effluent violations to the sewer system. Results from re-sampling must be submitted to the City of Lodi within 30 days of the slug load, spill or effluent violation.

C. All handling and preservation of collected samples and laboratory analyses of samples shall be performed in accordance with 40 CFR Part 136 and amendments thereto by a State certified laboratory unless specified otherwise in the monitoring conditions of the permit.

PART 3 - REPORTING REQUIREMENTS

A. Monitoring Reports

1. All monitoring and sampling results shall be reported to the City. The report should indicate the nature and concentration of all pollutants in the effluent which are regulated by the limits set forth in Part 1 A. Reports shall include a copy of all laboratory analysis reports, a summary of any violations of provisions in this permit, and a summary of other monitoring activities (such as pH and flow monitoring).

2. All wastewater user reports must be signed by an authorized representative of the user and contain the following certification statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

3. If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR Part 136 or as specified in this permit, the results of such monitoring shall be included in the calculations and results shall be reported in the monitoring report and submitted to the City of Lodi.

4. All monitoring reports are due 30 days after the conclusion of monitoring or receipt of the laboratory analysis report and shall be sent to the Water Services Manager at 1331 S. Ham Lane, Lodi, CA 95242.

5. All records must remain available for a period of at least three years per 40 CFR 403.12(0).

B. Accidental Discharge Report

1. The permittee shall notify the White Slough Water Pollution Control Facilities (WSWPCF) personnel immediately upon the occurrence of an accidental discharge of substances prohibited by City of Lodi Municipal Code, Chapter 13.12. During the hours of 7:00 a.m. to 11:00 p.m. WSWPCF personnel should be notified by telephone at 333-6749. At all other times, the City of Lodi alarm service, Bay Alarm Company, should be notified by telephone at 333-1231 to contact the on call operator. The notification shall include the location of discharge, date and time thereof, type of waste, including approximate concentration and volume, and corrective actions taken. Within ten days following an accidental discharge, the permittee shall submit to the City of Lodi a detailed written report. The report shall specify the following:

(Continued on next page)

REPORTING REQUIREMENTS (Continued)

a. Description and cause of the upset, slug or accidental discharge and the impact on the permittee's compliance status. The description should also include location of discharge, type, concentration and volume of waste.

b. Duration of noncompliance, including exact dates and times of noncompliance, and if the noncompliance continues, the time by which compliance is reasonably expected to occur.

c. All measures taken or to be taken to reduce, eliminate, and prevent recurrence of such an upset, slug, accidental discharge, or other conditions of noncompliance.

d. All accidental discharge reports shall be submitted to the City of Lodi, Public Works Director, 221 W. Pine Street, Lodi, CA 95240.

PART 4 - REOPENER CLAUSE

A. This permit may be reopened and modified to incorporate any new or revised requirements resulting from the City of Lodi's reevaluation of its local limits.

B. This permit may be reopened and modified to incorporate any new or revised requirements developed by the City of Lodi as are necessary to ensure POTW compliance with any new federal, state, or local regulations promulgated.

PART 5 - COMPLIANCE SCHEDULE

Not Applicable.

PART 6 - SPECIAL CONDITIONS

A. The City will supply well water to the facility for use in sinks, toilets, eyewashes and hosebibs with the agreement that at such time the City decides to replace the existing well that NCPA will share the cost of the replacement well including the cost of associated additional piping. All fixtures shall be posted with signs stating that the water is not designated for consumption.

B. A minimum of 20% of all wastewater on a yearly basis must be injected with the deep well injection system.

C. Operate and maintain a wastewater sampler, temperature recording, pH monitoring and flow monitoring equipment. Submit annual certification of calibration of flow and pH monitoring and temperature recording equipment.

D. Submit monthly summaries of the following:

1. Flow to NCPA from secondary clarifiers.
2. Flow to WSWPCF.
3. pH of flow to WSWPCF.
4. Temperature of flow to WSWPCF.
5. Injection Well Summary.

E. Oil/water separator on storm drain system must be maintained to operate at maximum efficiency.

F. Waste from cleaning of reverse osmosis membranes must not be discharged to the WSWPCF.

PART 7 - APPLICABLE PENALTIES

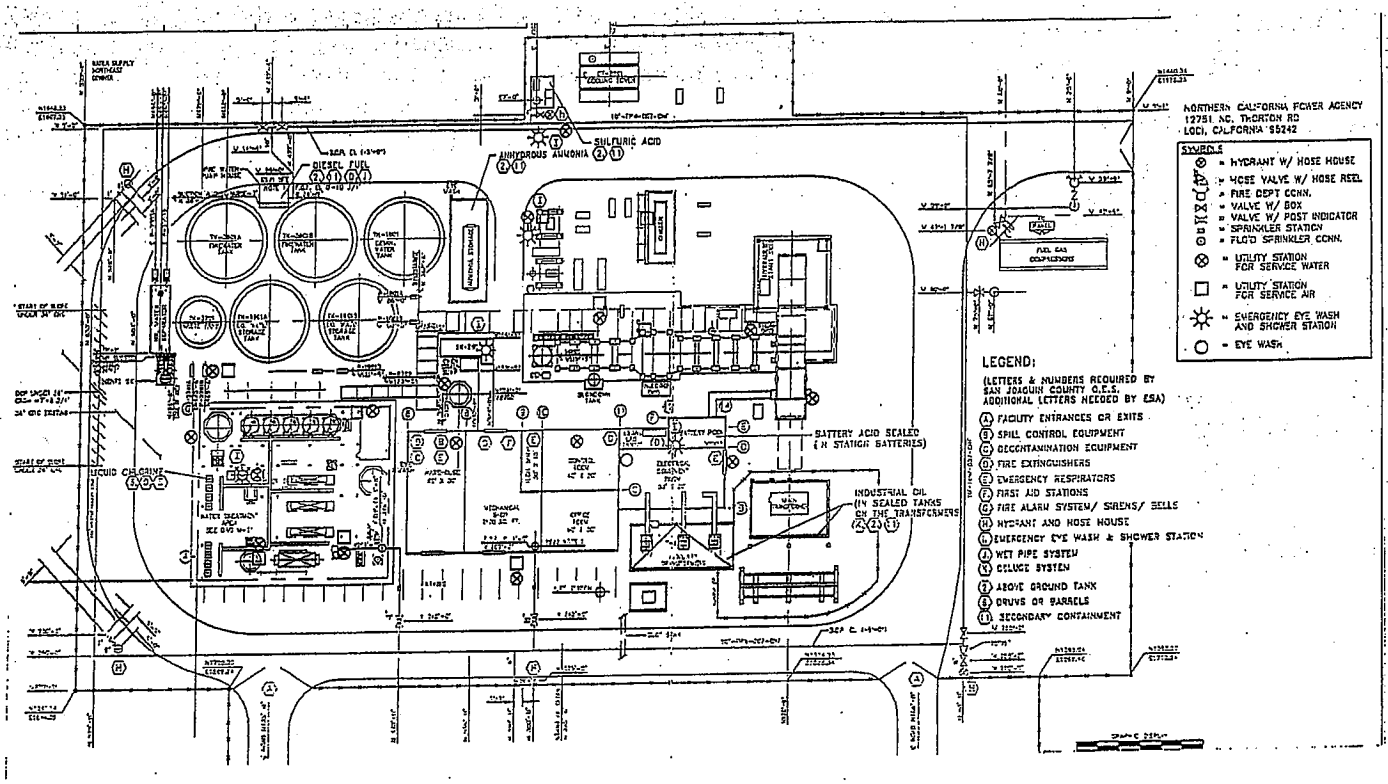
Penalties which may be assessed by the City for discharge or permit violations include: Notice of violation, Cease and Desist Order, Discharge Permit suspension or revocation, Compensation to the City for damages to POTW, civil penalties not to exceed six thousand dollars for each day in which such violation occurs, and termination of service.

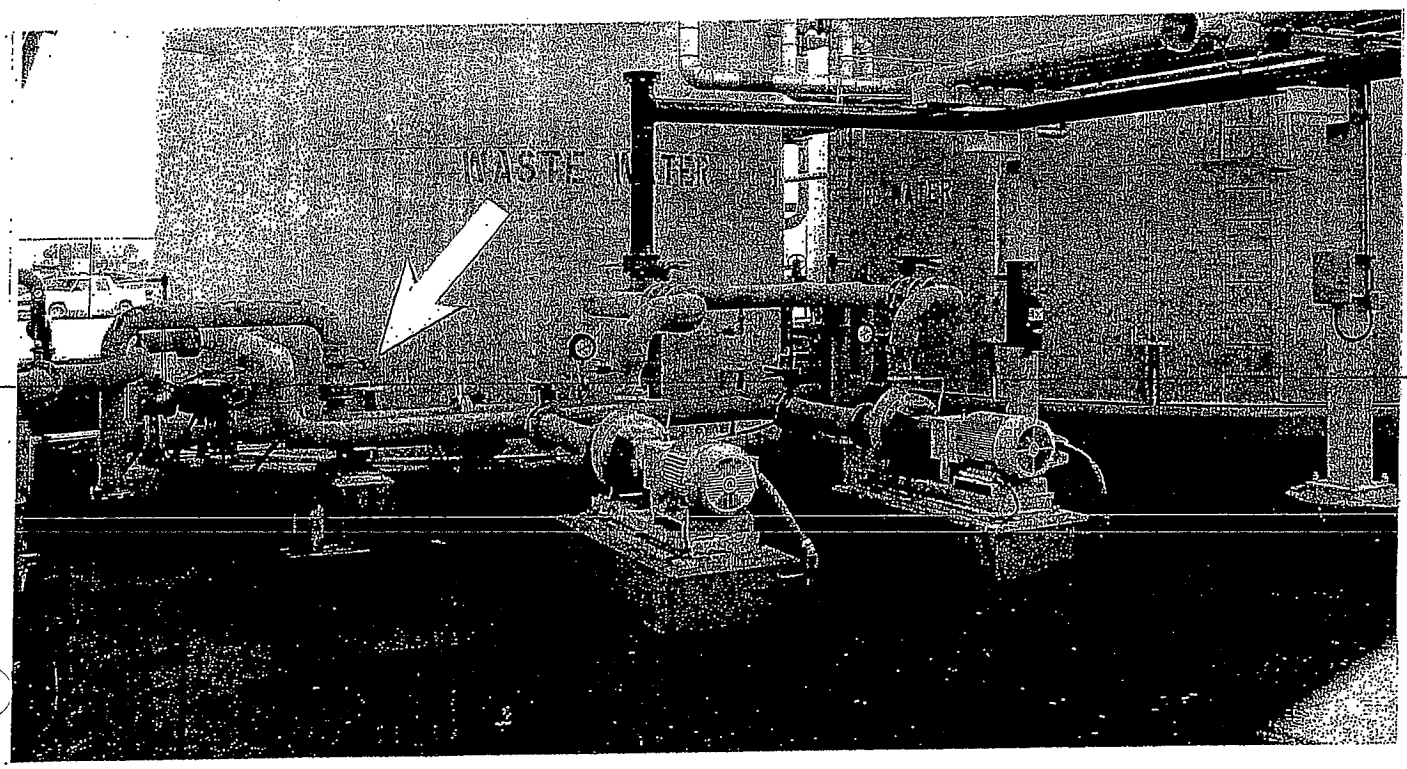
PART 8 - STANDARD CONDITIONS

See attached sections of City of Lodi Municipal Code Chapter 13.12

Appendix (A)

Sample Location





CITY COUNCIL
JOHN BECKMAN, Mayor
SUSAN HITCHCOCK
Mayor Pro Tempore
LARRY D. HANSEN
BOB JOHNSON
JOANNE L. MOUNCE

CITY OF LODI

PUBLIC WORKS DEPARTMENT

CITY HALL, 221 WEST PINE STREET
P.O. BOX 3006
LODI, CALIFORNIA 95241-1910
(209) 333-6706
FAX (209) 333-6710
EMAIL pwdept@lodi.gov
http:\\www.lodi.gov

BLAIR KING
City Manager
SUSAN J. BLACKSTON
City Clerk
D. STEPHEN SCHWABAUER
City Attorney
RICHARD C. PRIMA, JR.
Public Works Director

November 29, 2005

Randall Blank, Environmental, Health & Safety Manager
Northern California Power Agency
P.O. Box 1478
Lodi, CA 95241

SUBJECT: Site for NCPA Electric Generating Plant at Lodi White Slough Water Pollution Control Facility at 12745 North Thornton Road, Lodi, CA, 95242

The City of Lodi is pleased to confirm availability of the site for a new NCPA Electric Generating Facility adjacent to the existing NCPA STIG Plant located on City property at its White Slough Water Pollution Control Facility. A "Will Serve" letter for water supply is being sent separately. Pursuant to City Council approval on November 16, 2005, the City can provide:

- Permanent site space for the Plant itself, substation improvements, drying beds and associated access and utility corridors
- Temporary easements for construction and staging

The City cannot commit to accepting process return flow, as preliminary indications are that the salinity levels, and possibly temperature, of the City's total wastewater discharge would be raised to unacceptable levels for Delta discharge and possibly even for land disposal. While the City is willing to work with NCPA on possible mitigations that would allow such discharge, perhaps on a temporary basis, the City believes NCPA should plan the Plant for zero discharge. Discharge of domestic sewage from the Plant is permitted. However, potable water supplies are not available at the City's Facility.

Current City policy requires the applicant to fund/construct the improvements necessary to reliably serve your project. In addition, regular service charges for waste treatment, as established by the City, would apply.

While the current lease for the existing STIG Plant contemplates a second, similar-sized generating unit, should modifications of the lease be necessary to accommodate the larger proposed unit, the City will work with NCPA to resolve any issues.

The City of Lodi wishes to fully cooperate with you on this project and trusts that Lodi will be given favorable consideration in project participation allocations. We look forward to working with you on the various details to make this project a success for all.

Sincerely,

Richard C. Prima, Jr.
Public Works Director

RCP/pmf
cc: Blair King, City Manager
David Dockham, Interim Electric Utility Director
Del Kerlin, Assistant Wastewater Treatment Superintendent

J:\WHITE SLOUGH\NCPA_WILLSERVELETTER.DOC

APPENDIX 3

Letter to the City of Lodi

651 Commerce Drive
Roseville, CA 95678

(916) 781-3636

www.ncpa.com

October 10, 2008

F. Wally Sandelin, Public Works Director
City of Lodi
221 West Pine Street
Lodi, CA 95241-1910

Subject: STIG-LEC Facility Underground Injection Well Permit Status

Dear Mr. Sandelin:

The Northern California Power Agency (NCPA) is currently in the process of re-applying for a permit to continue operating the existing steam injected gas turbine (STIG)-1 injection well. The permit also includes installation of a new well (LEC-1) for the planned Lodi Energy Center (LEC) and a possible backup well (LEC-2) to support both plant wells. These wells, and the electrical generating Combustion Turbine Project #2 (STIG plant), are located on property that NCPA leases from the City of Lodi. NCPA has submitted an Application for Certification for a second power plant, the LEC, to be located immediately adjacent to the STIG plant. The two power plants are located in a complex that also includes the City's White Slough Water Pollution Control Facility.

STIG-1 was installed in 1993 and has operated efficiently and effectively since it began routine operation 2000. Therefore, as part of the planned operation of the LEC facility, installation of a second Class I injection well is planned. The underground injection control (UIC) permit application will be submitted to the United States Environmental Protection Agency next week.

The permitting process requires an estimation of the distance the injected fluid has penetrated and is expected to penetrate over the life of the facility. To date, approximately 71.5 million gallons have been injected at the STIG-1 well into the Domengine Formation. The Domengine Formation is a sandstone that has produced gas in the region and has well-defined confining units above and below to contain the injected fluid within it. It is estimated that the 71.5 million gallons of injected fluid has migrated approximately 160 feet away from the well head. With the proposed maximum injection rates of 200 gpm at the STIG-1 well and 225 gpm at the LEC-1 or LEC-2 wells, fluid migration will be an additional 950 feet after 10 years and less than 1,800 feet after 30 years. Fluid migration would remain beneath city property.

NCPA appreciates the relationship between our power facilities and the White Slough Water Pollution Control Facility. We currently anticipate the LEC-1 well will be drilled and tested in the fourth quarter of 2009, prior to initiating construction at the Lodi Energy Center. As the Application for Certification process continues with the California Energy Commission, and we have a better understanding of the schedule, we will keep the City informed as to the timing of the drilling and construction at the site.

Randall Blank, NCPA's Environmental Health and Safety Manager, is your point of contact if you have any questions about the UIC permit. He can be reached at either his office phone, (916) 781-4265, or cell phone, (209) 327-5397. If you have any further questions about the project, please do not hesitate to call me at (209) 728-1387 x22 or contact me at Ed.Warner@ncpagen.com.

Sincerely,

10/10

Ed Warner
Lodi Energy Center Project Manager

APPENDIX 4

DOGGR Well History Records for the Wells Within the AOR

Federal Imeson #1
API No. 07700509

FORM 159 (9-49)

7

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Coalinga, California

July 11, 19 55

Mr Ray Kepford, Agent
Federal Oil Company
219 West Euclid Street
Stockton California

Dear Sir:

Your report of abandonment of Well No. "Federal Imeson" 1, Sec. 26, T. 3S, R. 5E, M D B. & M., -- field, San Joaquin County, dated June 2, 1955, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

KPL:fd
cc: Company

E. H. MUSSER
State Oil and Gas Supervisor

By C. H. Corwin
Deputy Supervisor

95061 4-54 11,200 SPO

DIVISION OF OIL AND GAS

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B.&M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	____	Water Disposal	____
Idle - Oil	____	Water Flood	____
Abandoned - Oil	____	Steam Flood	____
Drilling - Idle	____	Fire Flood	____
Abandoned - Dry Hole	____	Air Injection	____
Producing - Gas	____	Gas Injection	____
Idle - Gas	____	CO_2 Injection	____
Abandoned - Gas	____	LPG Injection	____
Gas-Open to Oil Zone	____	Observation	____
Water Flood Source	____		

DATE _____

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod. Dir. Sur. _____

CLERICAL CHECK LIST

1. Location change ____ (F-OGD165) _____
2. Elevation change ____ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records due (F-OGD170) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED _____

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK _____

LONG BEACH OFFICE - USE REVERSE SIDE

OG101 (3-77-OSR1-4M)

FORM 100.
CALIFORNIA STATE PRINTING OFFICE

SUBMIT LOG IN DUPLICATE
FILL THIS BLANK IN WITH TYPEWRITER. WRITE ON ONE SIDE OF PAPER ONLY

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

San Joaquin County

Operator Federal Oil Company Field Lodi-Stockton Area

Well No. Federal Imeson No. 1 Sec. 26, T. 3N, R. 5E, M.D. B. & M.

Location ~~270'N~~ & ~~660'W~~ from E¼ Cor. Sec. 26 Elevation of ground above sea level 3' feet.

All depth measurements taken from top of KB, which is 10 feet above ground.

Kelly Bushing Elev. is 13'

In compliance with the provisions of Chapter 93, Statutes of 1939, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date 6-2-55 Signed L. W. Frankley

John Knudsen, Jr. (Engineer or Geologist) James G. Creed (Superintendent) Title President (President, Secretary or Agent)

Commenced drilling 5-21-1955 Completed drilling 5-30-1955 Drilling tools Cable Rotary

Total depth 4875 Plugged depth 1305 & 474 GEOLOGICAL MARKERS DEPTH

Junk None See Elog.

Commenced producing Abandoned (date) Flowing/gas lift/pumping (cross out unnecessary words)

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cementing if through perforations
8 5/8	501	0	24#	New	Smls.	H-40	12¼	265	

PERFORATIONS

Size of Casing	From	To	Size of Perforations	Number of Rows	Distance Between Centers	Method of Perforations
	ft.	ft.				
	ft.	ft.				
	ft.	ft.				
	ft.	ft.				
	ft.	ft.				

Electrical Log Depths 501-4875! (Attach Copy of Log)

CALIFORNIA STATE PRINTING OFFICE

SUBMIT IN DUPLICATE

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR Federal Oil Company FIELD Loui-Stockton Area

Well No. Federal Imeson No. 1, Sec. 26, T. 3S, R. 5E, M.D. B. & M.

Signed B. D. Moulley

Date June 2, 1955 Title President

(President, Secretary or Agent)

It is of the greatest importance to have a complete history of the well. **Use this form in reporting the history of all important operations at the well, together with the dates thereof, prior to the first production.** Include in your report such information as size of hole drilled to cementing or landing depth of casings, number of sacks of cement used in the plugging, number of sacks or number of feet of cement drilled out of casing, depth at which cement plugs started, and depth at which hard cement encountered. If the well was dynamited, give date, size, position and number of shots. If plugs or bridges were put in to test for water, state kind of material used, position and results of pumping or bailing.

Date		
May 1955		
21	0-256	Rig up. Drilled 12¼ - repairing Torque Converter.
22	256-501	Repaired Torque Converter. Drilled 12¼ hole to 501' and ran (502.86') 12 joints of 8 5/8 - 24# new 8 round thread casing to 501' and cemented with 2.5 sacks construction cement with the last 100 sacks treated. Displaced cement with 193 cu. ft. of mud. No cement returns. Filled in around top of 8 5/8 with 40 sacks cement. Halliburton equipment. Tested B.O.P. to 1000#.
23	501-1122	Drilled 7 7/8" hole. Mud 78-78 lb.
24	1122-2576	Drilled 7 7/8" hole. Mud 80-84.5 lb. Checked B.O.P.
25	2576-3381	Drilled 7 7/8" hole. Mud 80-86 lb. Survey @ 2577' 0°20".
26	3381-4112	Drilled 7 7/8" hole. Mud 84-87 lb. Checked B.O.P.
27	4112-4315	Drilled 7 7/8" hole. Mud 81-85 lb. Checked B.O.P.
28	4315-4633	Drilled 7 7/8" hole. Mud 79-84 lb. Checked B.O.P.
29	4633-4875	Drilled 7 7/8" hole. Mud 79-81 lb. Ran Schlumberger Electric log to 501-4875'. Hung 4" drill pipe at 1490' and pumped in 20 cu. ft. water followed by 35 sacks type O cement (treated) followed by 5 cu. ft. water and displaced with 80 cu. ft. water. Halliburton equipment.
30		Ran in and found top of cement plug at 1705'. Hung 4" drill pipe at 525' and pumped in 30 sacks treated cement. Found top of cement plug at 474'. Put in 10' cement plug at surface and capped 8 5/8" casing.

Rusty Walters Drilling Contractor.

FORM 111 (1-49)

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS

No. P 655-94

Mr. Ray Kepford
219 West Euclid Street
Stockton California
Agent for FEDERAL OIL COMPANY

Coalinga Calif.
June 7 1955

DEAR SIR:

Your proposal to abandon Well No. "Federal Imeson" 1,

Section 26, T. 3 N., R. 5 E., M.D. B. & M., ——— Field, San Joaquin County,

dated May 31 1955, received June 6 1955, has been examined in conjunction with records filed in this office.

Present conditions as shown by the records and the proposal are as follows:

RECORDS IN ADDITION TO OR AT VARIANCE WITH THOSE SHOWN IN THE NOTICE:

The well was drilled to a reported total depth of 4875'.

THE NOTICE STATES:

"The present condition of the well is as follows:

1. Complete casing record.
   8-5/8 Cmt. 501 w/265 sax.
2. Last produced. Never"

PROPOSAL:

"The proposed work is as follows:
Place a cement plug from 1430 - 1305'.
" " " " " 525 - 474'."

DECISION:

THE PROPOSAL IS APPROVED PROVIDED THAT the cement plugs at 1305' and 474' are accurately located.

Bond No. 96116 dated 4-19-55
CHC:ef
cc: Company

E. H. MUSSER, State Oil and Gas Supervisor

By C. H. Corwin, Deputy

115

11210 1-55 30M SPO

FORM 108. 42777 2-45 7500
CALIFORNIA STATE PRINTING OFFICE

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin

Beverly Hills, Calif. May 31 1955

DIVISION OF OIL AND GAS

Coalinga, Calif.

In compliance with Secs. 3228, 3229, 3230, 3231 and 3232, Ch. 93, Stat. 1939, notice is hereby given that it is our intention to abandon well No. Federal-Imeson No. 1

Sec. 26, T. 3N, R. 5E, M. D. B. & M. Lodi-Stockton Area Field,

San Joaquin County, commencing work on the 30th day

of May 1955.

The present condition of the well is as follows:

1. Complete casing record.

8-5/8 Cmt. 501' w/265 sax.

2. Last produced. Never

Date	Net oil	Gravity	Cut

The proposed work is as follows:

Place a cement plug from 1420 - 1305'.
" " " " " 525 - 474'.

FEDERAL OIL COMPANY
(Name of Operator)

By John Kinsman
Engineer

ADDRESS NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

FORM 111 (1-49)

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS

No. P 655-63

Mr. Ray Kepford
219 West Euclid Street
Stockton California
Agent for FEDERAL OIL COMPANY

Coalinga Calif.
April 28 1955

DEAR SIR:

Your proposal to drill Well No. "Federal Imeson" 1,

Section 26, T. 3 N., R. 5 E., M. D.B. & M., ----- Field, San Joaquin County,

dated April 21 1955, received April 27 1955, has been examined in conjunction with records filed in this office.

Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:

"Legal description of lease N1/2 Sec. 25 and portion of N1/2 Sec. 26
The well is 660 feet N., and 270 feet E. from the NW/4 Corner of Sec. 26
Elevation of ground above sea level 3 feet.
All depth measurements taken from top of Kelly Bushing, which is 10 feet above ground."
We estimate that the first productive oil or gas sand should be encountered at a depth of about 4650 feet."

PROPOSAL:

"We propose to use the following strings of casing, either cementing or landing them as herein indicated:

Size of Casing, Inches	Weight, Lb. Per Foot	Grade and Type	Depth	Landed or Cemented
8 5/8"	32	H-40	501	Cemented
5 1/2"	17	J-55	4800	Cemented

Well is to be drilled with rotary tools.
It is understood that if changes in this plan become necessary we are to notify you before cementing or landing casing."

DECISION:

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8-5/8" surface casing shall be cemented with sufficient cement to fill back of this casing from the shoe to the ground surface.
2. Mud fluid of sufficient weight and proper consistency to prevent blow-outs shall be used in drilling, and the column of mud fluid shall be maintained to the surface at all times, particularly while pulling the drill pipe.
3. Adequate blow-out prevention equipment shall be provided and kept ready for operation at all times.
4. Sufficient cement shall be used to fill back of the 5½" casing to above the highest zone containing oil or gas.
5. Water suitable for irrigation shall be protected from contamination.
6. This Division shall be notified to witness a test of the 5½" water shut-off through four shot perforations immediately above the objective sand, prior to perforating the casing for production.

Bond No. 96116 dated 4-19-55
CHC:ef
cc: Company

E. H. MUSSER, State Oil and Gas Supervisor

By C. H. Corwin, Deputy

11210 1-55 30M SPO

Form 105
[illegible]

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

8

077-00509

Notice of Intention to Drill New Well

This notice must be given and surety bond filed before drilling begins

Beverly Hills, Calif. April 21 1955

DIVISION OF OIL AND GAS

Coalinga Calif.

In compliance with Section 3203, Chapter 93, Statutes of 1939, notice is hereby given that it is our intention to commence the work of drilling well No. Federal Imeson No. 1, Sec. 26, T. 3N. R. 5E., M.D. B. & M., Stockton Area Field, San Joaquin County.

Legal description of lease N1/2 Sec. 25 and portion of N1/2 Sec. 26

The well is 660 feet N. ~~or S.~~, and 270 feet ~~E. or~~ W. from the E1/4 Corner of Sec. 26
(Give location in distance from section corners or other corners of legal subdivision)

Elevation of ground above sea level 3 feet.

All depth measurements taken from top of Kelly Bushing, which is 10 feet above ground.

We estimate that the first productive oil or gas sand should be encountered at a depth of about 4650 feet.

We propose to use the following strings of casing, either cementing or landing them as herein indicated:

Size of Casing, Inches	Weight, Lb. Per Foot	Grade and Type	Depth	Landed or Cemented
8 5/8"	32	H-40	501	Cemented
5 1/2"	17	J-55	4800	Cemented

Well is to be drilled with ~~rotary~~ cable tools. E

It is understood that if changes in this plan become necessary we are to notify you before cementing or landing casing.

Address 9424 Dayton Way

Telephone number Bradshaw 23259

Federal Oil Company
(Name of Operator)

By L. W. Frankley
L. W. Frankley

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

077 00509

SCHLUMBERGER WELL SURVEYING CORPORATION

HOUSTON, TEXAS

Electrical Log

COUNTY SAN JOAQUIN
FIELD or LOCATION LODI
WELL 26-3N-6E FEDERAL IMESON NO. 1
COMPANY FEDERAL OIL CO.

COMPANY FEDERAL OIL COMPANY
WELL "FEDERAL IMESON" NO. 1 (077-03509)
FIELD ~~LODI~~
LOCATION 26 - 3N - ~~6E~~ 5E 8
COUNTY SAN JOAQUIN
STATE CALIFORNIA

Location of Well

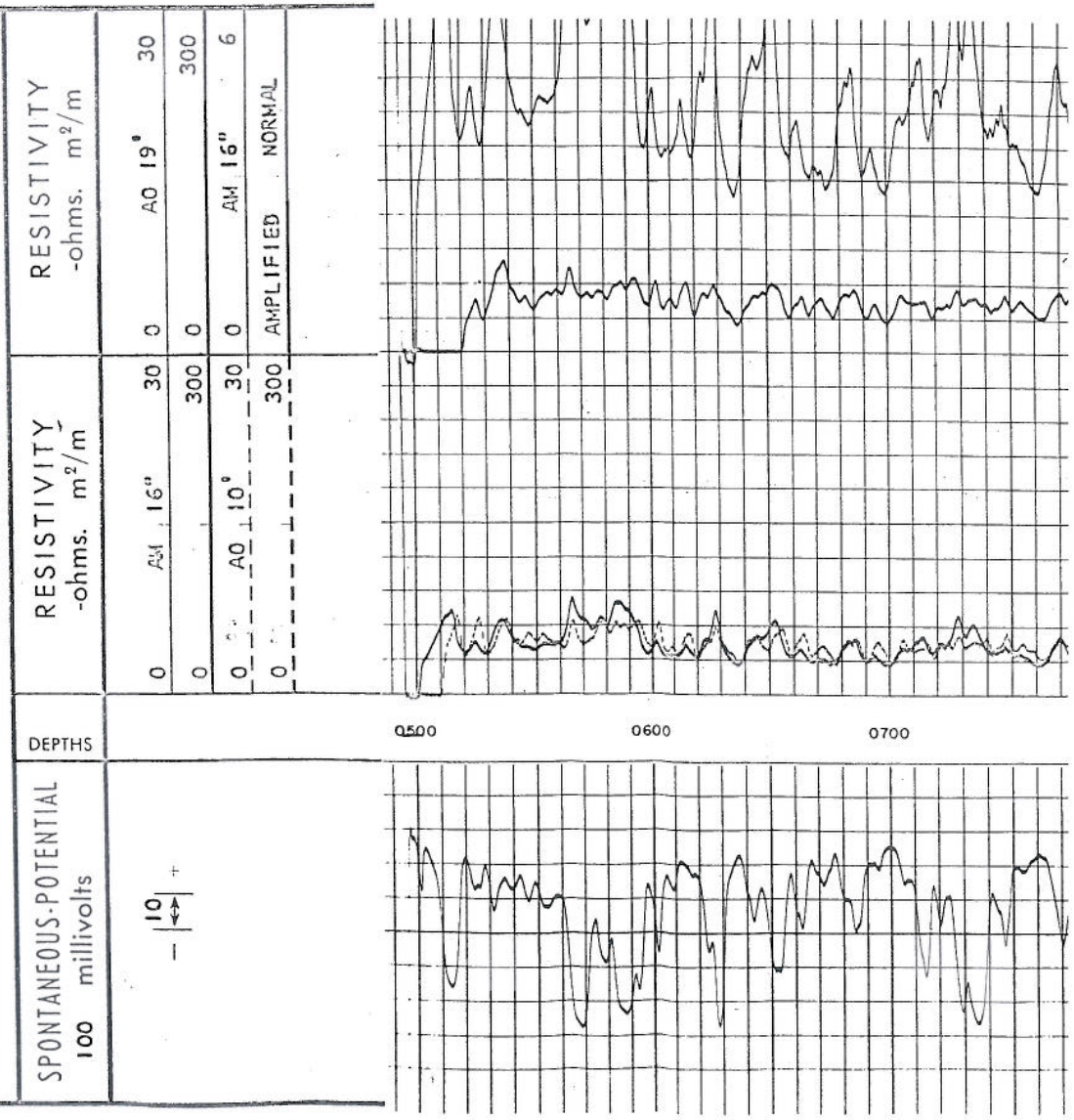
(ES ONLY)
Elevation: D.F.:
K.B.: 13
or G.L.:

FILING No.

RUN No.	ONE				
Date	5-29-55				
First Reading	4874				
Last Reading	501				
Feet Measured	4373				
Csg. Schlum.	501				
Csg. Driller	501				
Depth Reached	4876				
Bottom Driller	4875				
Depth Datum	KB				
Mud Nat.	P-95∞				
" Density	81				
" Viscosity	57				
" Resist.	5.4@ 87 F	@ F	@ F	@ F	@ F
" Res. BHT	4.2@115 F	@ F	@ F	@ F	@ F
" pH	8.0@ 87 F	@ F	@ F	@ F	@ F
" Wtr. Loss	- CC 30 min.	CC 30 min.	CC 30 min.	CC 30 min.	CC 30 min.
Max. Temp. °F	115°				
Bit Size	7⅞"				
Spcgs.—AM	16"				
A 0	10"				
AO	19"				
Opr. Rig Time	1:30				
Truck No.	605 SAC				
Recorded By	HILLBLOM				
Witnessed By	KNUDSEN				

FOLD HERE

REMARKS ∞MUD SAMPLE TAKEN FROM MUD PIT



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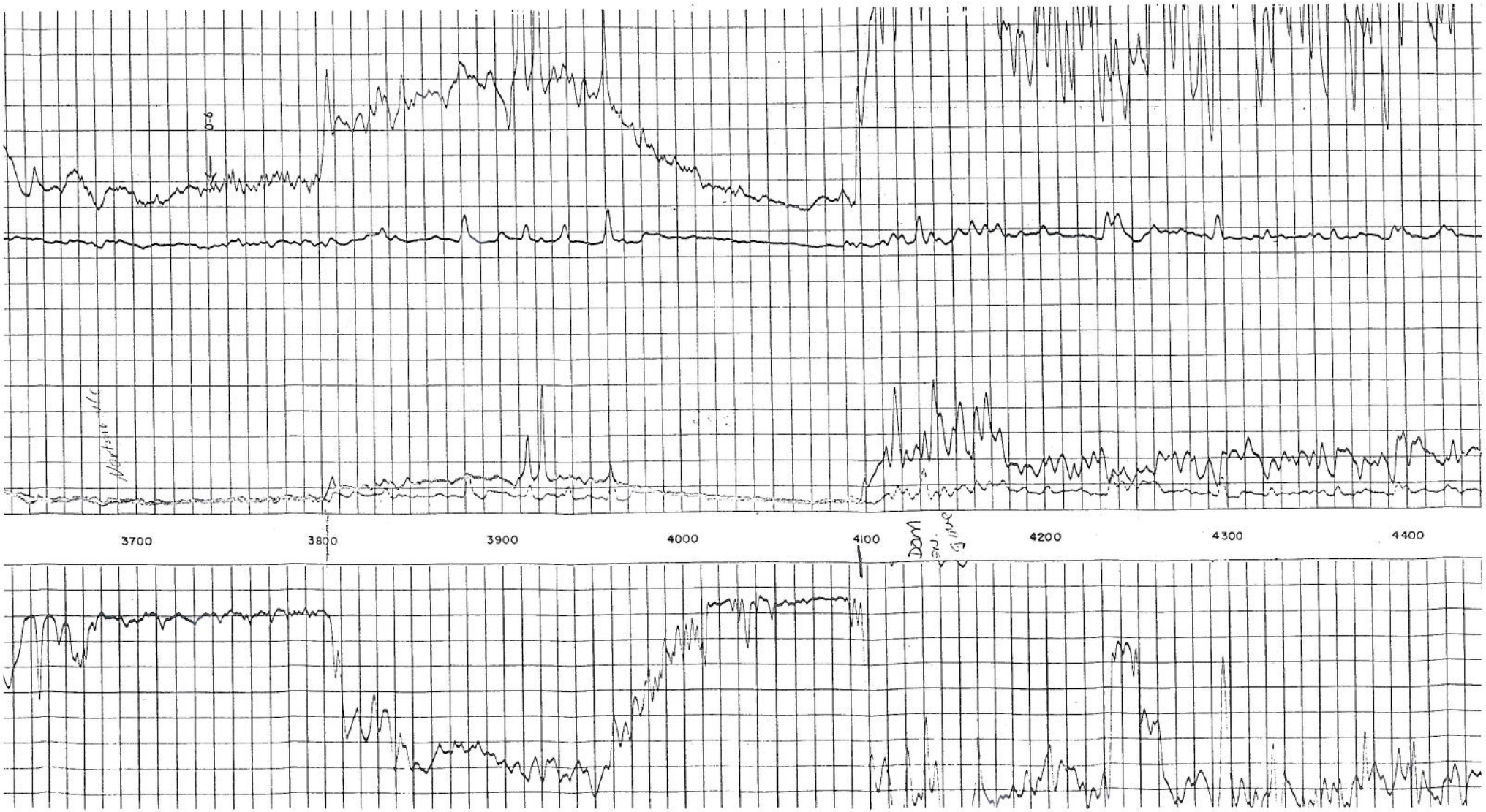
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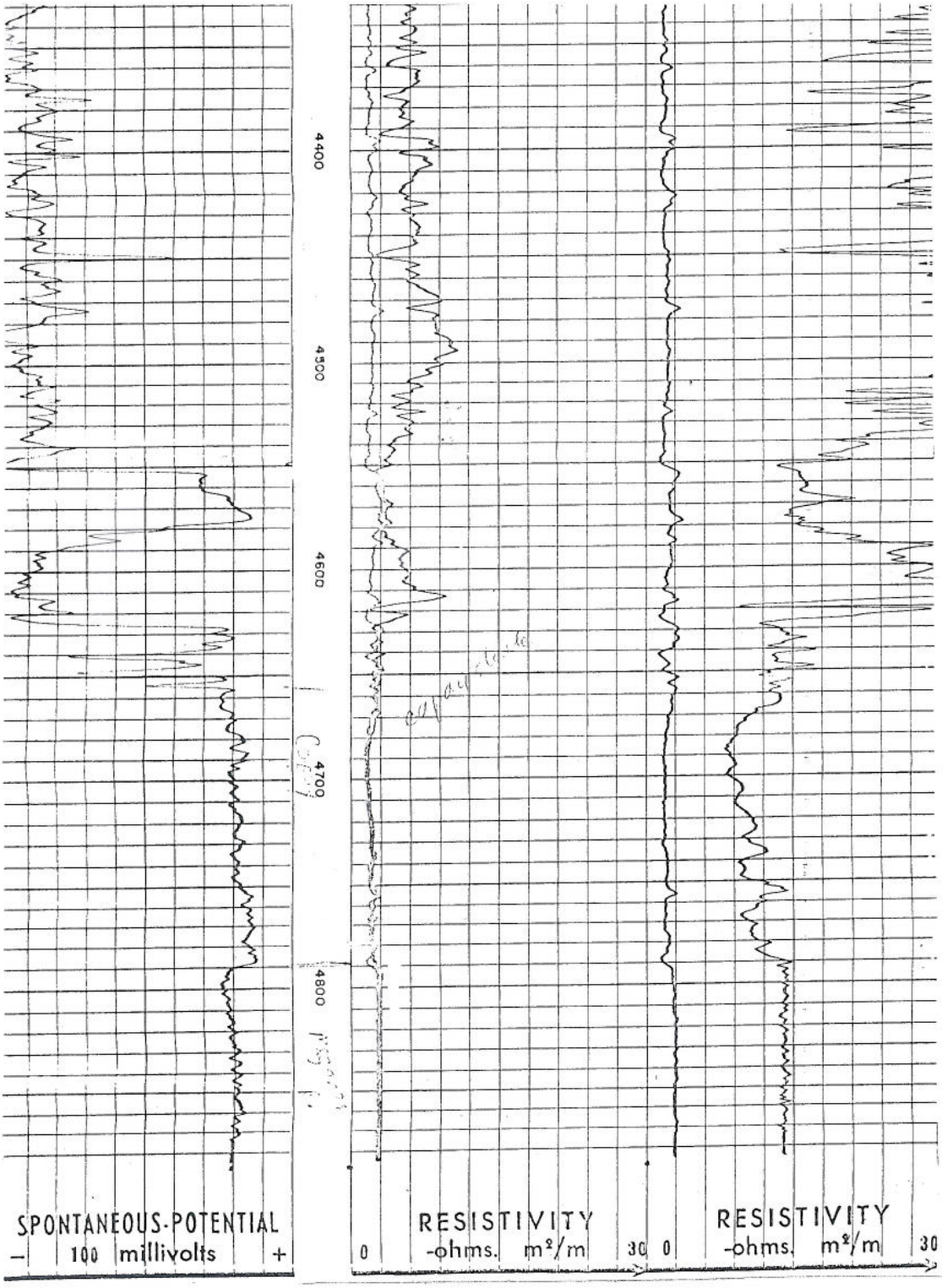
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4800
SPONTANEOUS-POTENTIAL
– 100 millivolts +
RESISTIVITY
0 -ohms. m²/m 30
RESISTIVITY
0 -ohms. m²/m 30

City of Lodi #1
API No. 07720290

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, Caliifornia

April 11, 1977

Mr. Charles W. Hutton, Agent
GREAT BASINS PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, CA 90067

DEAR SIR:

Your report of abandonment of Well No. "City of Lodi" 1 (077-20290), Sec. 24, T. 3N, R. 5E, M.D. B. & M., — field, San Joaquin County, dated 12/22/76, received 3/16/77, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

Environmental inspection made and approved 1/15/77

Blanket Bond
JR:rmo

M. G. MEFFERD, Acting Chief
State Oil and Gas Supervisor

#610
OK
JCS

By Original signed by John C. Sullivan
Deputy Supervisor

OG159 (2-75 GSR 1-8M)

DIVISION OF OIL AND GAS

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company Great Basin Pet. Co. Well No. "City of Lodi" 1

API No. 077-20290 Sec. 24, T. 3N, R. 5E, M.D. B.&M.

County San Joaquin Field —

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	12/30/76
History (Form OG103)	✓
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	
2 DIL	12/30/76
2 Sonic	12/30/76.

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Water Flood	
Abandoned - Oil		Steam Flood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole	✓	Air Injection	
Producing - Gas		Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas		LPG Injection	
Gas-Open to Oil Zone		Observation	
Water Flood Source			

DATE

RECOMPLETED

REMARKS

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports ✓
10. Casing Record ✓
11. Plugs ✓
12. Surface Inspection ✓
13. Production
14. E Well on Prod. Dir. Sur.

CLERICAL CHECK LIST

1. Location change (F-OGD165)
2. Elevation change (F-OGD165)
3. Form OGD121 ✓
4. Form OG159 (Final Letter) Yes
5. Form OGD150b (Release of Bond) B/B
6. Duplicate logs to archives
7. Notice of Records due (F-OGD170)

final letter

RECORDS NOT APPROVED DLO 3/7/77

Reason: need 2 copies of mud log.

RECORDS APPROVED DLO 4/8/77

RELEASE BOND

Date Eligible

(Use date last needed records were received.)

MAP AND MAP BOOK

OGD2 (2-75-GSR1-4M)

LONG BEACH OFFICE - USE REVERSE SIDE

RM 10

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

SUBMIT IN DUPLICATE

DIVISION OF OIL AND GAS
RECEIVED
DEC 29 1976
WOODLAND, CALIFORNIA

077-20290

Operator Great Basins Petroleum Co. Well No. City of Lodi #1

Sec. 24, T. 3N, R. 5E, M.D. B. & M. ~~Lodi Airport~~ Field San Joaquin County.

Location 1320' North and 1728' East from Southwest Corner Sec. 24, T. 3N., R. 5E.
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level 6.70' feet.

All depth measurements taken from top of Kelly Bushing which is 10' feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

In compliance with Sec. 3215, of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date 12/22/76 Signed Charles W. Hatten

J. R. Kandle (Engineer) C. F. Manlove (Geologist) Title President (President, Secretary or Agent)

Commenced drilling 11/22/76

Completed drilling 11/30/76

Total depth 6703' Plugged depth 638', 430' and surface

Junk None

GEOLOGICAL MARKERS	DEPTH
Domengine	3710'
2nd & 3rd Massive Sd.	5280'
Winters Sand	6610'

Geologic age at total depth: Cretaceous

Commenced producing Dry Hole (Date) Flowing gas lift pumping (Cross out unnecessary words)

Name of producing zone None

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production	Dry Hole					
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cementing if through perforation
8-5/8"	740'	0	24	New	Smls	K-55	12 1/4"	325	- - -

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was the well directionally drilled? No Electrical Log Depths 6709' (Attach Copy of Log)

△ OSP

FORM 103

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR Great Basins Petroleum Co. FIELD Lodi Airport

Well No. City of Lodi #1, Sec. 24, T. 3N., R. 5E., M.D. B. & M.

Date December 22, 1976 Signed Charles W. Hatten

Charles W. Hatten

1011 Gateway West - Century City
Los Angeles, CA 90067 (213) 879-0666 Title President
(Address) (Telephone Number) (President, Secretary or Agent)

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data.

Date	
11/23/76	Cemented 16" conductor pipe at 55' before rig moved in. Moved in Perryman Drilling Co. rig # 1, rigged up and spud 6:30 P.M. 11/22/76.
	741' Drilled 12¼" hole to 741'. Mud 72#, 50 vis. Surveys 1° - 275', 0° 45' - 741'. Ran 15 jts. 8-5/8" 24# K-55 SJ&C casing, cemented at 740' with 200 sax Class G cement premixed with 2% Gell and 2% Calcium Chloride, followed with 125 sax Class G with 2% Calcium Chloride CIP 5:15 A.M. Used Guide Shoe and Filtrol Collar, 4 B&W Centralizers. B&J Equipment.
11/24/76	1887' W.O.C. 4hrs. Land casing, installed 10" Ser. 900 casing head. Install 10" Ser. 900 Double Ram & Hydrill B.O.P.E. Tested to 1000 PSI. Witnessed and approved by John Reynolds, D.O.G. Drill out collar at 700', cement to 741'. Installed stratographic loggers at 741'. Drilled 7-7/8" hole, to 1887', Mud 72#, 40 Vis. Surveys 1°15' at 1240', 0°30' at 1756'.
11/25/76	3412' Drilled 7-7/8" hole to 3412', Mud 72#, 42 Vis. Surveys 0°15' at 2214', 0°45' at 2207', 0°15' at 2841', 1° at 3341'.
11/26/76	4762' Drilled 7-7/8" hole to 4762', Mud 77#, Vis. 43. Surveys 0°45' at 3834', 1° at 4327'.
11/27/76	5477' Drilled 7-7/8" hole to 5477', Mud 75#, Vis. 44, Survey 4819' 1°.
11/28/76	5846' Drilled 7-7/8" hole to 5846', Mud 74#, Vis. 46, Survey 0°45' at 5766'.
11/29/76	6456' Drilled 7-7/8" hole to 6456', Mud 76#, Vis. 50, Survey 1°30' at 6128'.
11/30/76	6703' Drilled 7-7/8" hole to 6703', Mud 75#, Vis. 45, Survey 1°15' at 6694'. Circ. & Cond. Mud Ran Schlumberger D.I.L. and B.H.C. Sonic Logs.

12/1/76	6703'	Hung drill pipe at 797', pumped in 50 Cu.Ft. water followed with 75 sax Class G cement treated with 3% Calcium Chloride. W.O.C. 3½hrs. Tagged top cement plug at 735'. With drill pipe at 735' pumped in 30 sax Class G cement treated with 2% Calcium Chloride. W.O.C. Tagged top cement plug at 638'. Witnessed and approved by Dennis Olmsfeld, D.O.G. Pulled up to and pumped in 31 sax Class G cement treated with 2% Calcium Chloride. Estimate top at 430' Plugged top of surface casing 90' to surface. Tore out B.O.P.E. Cut off 8-5/8" casing 5' below ground level. Weld steel plate on top of casing. Filled Mouse and Rat Holes with cement.
12/10/76		Filled Sellar, Pits, Cleaned up location and restored surface to contour. Approved by City of Lodi.

FORM 109

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Report on Operations

No. T 676-582

Mr. Charles W. Hutton, Agent
GREAT BASINS PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, Cal. 90067

Woodland, Calif.
December 28, 1976

DEAR SIR:

Operations at well No. "City of Lodi" 1, API No. 077-20290, Sec. 24, T. 3N, R. 5E, M.D., B & M. - - - Field, in San Joaquin County, were witnessed on November 30, 1976. Mr. D. Olmstead, representative of the supervisor was present from 1600 to 1630. There were also present D. Perryman, Drilling Foreman.

Present condition of well: 8 5/8" csg. 740'. TD 6701'. Plugged with cement. 797'-600'±, 488'-393', 88'-6'.

The operations were performed for the purpose of abandonment.

DECISION:

The plugging operations as witnessed and reported are approved.

DO/cl
cc: Company, Los Angeles

M.G. MEFFERD, ACTING CHIEF
~~XXXXXXXXXXXXXXXXXXXX~~
JOHN F. MATTHEWS, JR.
State Oil and Gas Supervisor

By Original signed by John C. Sullivan Deputy

FORM 109 (REV. 1-73)

19190-708 11-73 20M ⓐ OSP

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 676- 449

Mr. Charles H. Hutton, Agent
GREAT BASIN PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, CA. 90067

Woodland, Calif.
December 28, 1976

DEAR SIR:

Your proposal to abandon Well No. "City of Lodi" 1 (077-20290), Section 24 T. 3N, R. 5E M.D. B. & M., - - - Field, San Joaquin County, dated 11/30/76, received 12/27/76, has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT THIS DIVISION IS NOTIFIED WHEN THE WELLSITE HAS BEEN RESTORED TO A CONDITION THAT WILL PASS ENVIRONMENTAL INSPECTION.

NOTE: 1. RECORDS FOR ALL WORK DONE UNDER THIS APPROVAL ARE DUE WITHIN 60 DAYS AFTER COMPLETION OF THE WORK.

Blanket Bond
JP/cl
cc: Company, Los Angeles

M.S. MEYFERD, ACTING CHIEF
[redacted], State Oil and Gas Supervisor

By Original Signed By, Deputy

25476-705 7-74 50M ⓓD OSP
OG 111

FORM 108. 88930-705 2-67 10M ⓢ OSP

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
DEC 27 1976
WOODLAND, CALIFORNIA

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin; one copy only

Los Angeles Calif. November 30 1976

DIVISION OF OIL AND GAS

In compliance with Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon

Well No. City of Lodi #1, Sec. 24, T. 3N, R. 5E, M.D. B. & M., Lodi Area Field, San Joaquin County,

commencing work on November 30 1976.

THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 6703'

2. Complete casing record, including plugs:

8-5/8" cmt. 740'

3. Last Produced Dry Hole
(Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:

None

5. Stratigraphic markers and depths:

Top Domengine	3758'
Base Capay Shale	4685'
Top Winters Shale	6272'

6. Formation at bottom: Cretaceous

7. Base of fresh water sands: Above 740'

THE PROPOSED WORK IS

1. With hole full of 75# mud, hang drill pipe at 790'± and equalize 75 sax cement treated with 2% calcium chloride. Cement calculated to fill to 560'. Plug to be witnessed by D.O.G.
2. Hang drill pipe at 500' and equalize 30 sax cement. Plug to protect fresh water.
3. Place 100'± cement plug in top of surface casing. To be witnessed by D.O.G.
4. Remove B.O.P.E. Cut off casing 5'± below ground level, weld steel plate on top of 8-5/8" surface casing.
5. Fill in cellar, rat and mouse holes and restore surface to contour.

MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
		✓	BB	✓	✓

C77-20290

1011 Gateway West, Century City
Los Angeles, California 90067
(Address)

(213) 879-0666
(Telephone No.)

Great Basins Petroleum Co.
(Name of Operator)

By Charles W. Hatten
Charles W. Hatten, President

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Report on Operations

No. T 676-347

Mr. Charles M. Hatten, Agent
GREAT BASINS PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, CA. 90067

Woodland Calif.
November 29, 1976

DEAR SIR:

Operations at well No. "City of Lodi" 1, API No. 077-20290, Sec. 24, T. 3N, R. 5E, M.D., B & M. * * * Field in San Joaquin County, were witnessed on 11/23/76 Mr. J. Reynolds, representative of the supervisor was present from 1600 to 1700. There were also present D. Perryman, Drilling Foreman.

Present condition of well: 8 5/8" cem. 740'. TD 740', (standing cemented).

The operations were performed for the purpose of testing the blowout-prevention equipment and installation.

DECISION

The blowout-prevention equipment and installation are approved.

JR/cl
cc: Great Basins Petroleum Co.
Los Angeles

M.G. MEFFERD, ACTING CHIEF
~~XXXXXXXXXXXXXXXXXX~~
JOHN F. MATTHEWS, JR.
State Oil and Gas Supervisor

By Orig. signed by John C. Sullivan Deputy

OG109 (2-75 OSP 20M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

WELL CLASSIFICATION:
EXPLORATORY

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 676-348

Mr. Charles H. Hatten, Agent
GREAT BASINS PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, CA 90067

Woodland, Calif.
October 21, 1976

DEAR SIR:

(077-20290)

Your proposal to drill Well No. "City of Lodi" 1, Section 24, T. 3N, R. 5E, M.D. B. & M., - - Field, San Joaquin County, dated 10/12/76, received 10/15/76, has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
3. Blowout-prevention equipment conforming to Division of Oil and Gas Dist. 6 Class IV requirements is installed on the 8 5/8" casing and maintained ready for use at all times. See attached sheet.
4. Adequate blowout-prevention equipment is installed on the 5½" casing and maintained ready for use at all times.
5. A copy of this report and accompanying material is posted at the wellsite prior to commencing operations.
6. This Division is notified:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a pressure test of the annular/bag and pipe rams prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank test will be entered on the tour sheet along with signature of the person in charge.
   c. To witness a test of the 5½" water shut-off immediately above the objective zone.

NOTE:

1. RECORDS FOR ALL WORK DONE UNDER THIS APPROVAL ARE DUE WITHIN 60 DAYS AFTER COMPLETION OF THE WORK.
2. Information on file in this office indicates that the base of the usable fresh water deposits should be encountered at a depth of approximately 500'.

Blanket Bond
DO:jp
Encl.
cc: Co., L.A.

HAROLD W. BERTHOLF
~~JOHN E. MATTHEWS~~ State Oil and Gas Supervisor

By Orig. signed by John C. Sullivan, Deputy

25476-705 7-74 50M ⓘD OSP
OG 111

FORM 105

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and surety bond must be filed before drilling begins

DIVISION OF OIL AND GAS
RECEIVED
OCT 15 1976
WOODLAND, CALIFORNIA

Possible 3600

→ 1500' Los Angeles Calif. October 12 1976

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division III, Article 4, Public Resources Code, notice is hereby given that it is our intention to commence drilling well No. ~~Sec.~~ "City of Lodi" #1, Sec. 24, T. 3N, R. 5E, M.D. B. & M., Exploratory well Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 525.14 acres, is as follows: Please refer to (Attach map or plat to scale) attached legal description & plat to scale of 1" = 2000'

Do mineral and surface leases coincide? Yes X No ____ If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of Well: 1320 feet North (Direction) along ~~property~~ section line and 1728' feet East (Direction) at right angles to said line from the Southwest corner of ~~property~~ section 24, T3N, R5E, MDB & M, San Joaquin County, California

Elevation of ground above sea level 6.70' feet U.S.G.S. datum.

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table or Kelly Bushing) which is 10.0 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES A.P.I.	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS
8 5/8"	24#	H-40	Surface	675	Shoe/surface
5 1/2"	17# 20#	P-110 N-80	Surface	6500	Shoe/surface

Intended zone(s) of completion: 2nd & 3rd. Massive sands (Name) 5250'/5850' (Depth, top and bottom) Estimated total depth 6500'

John Walker D.O.T. 209-948-7923
well is 110' NE of Free-way right of way

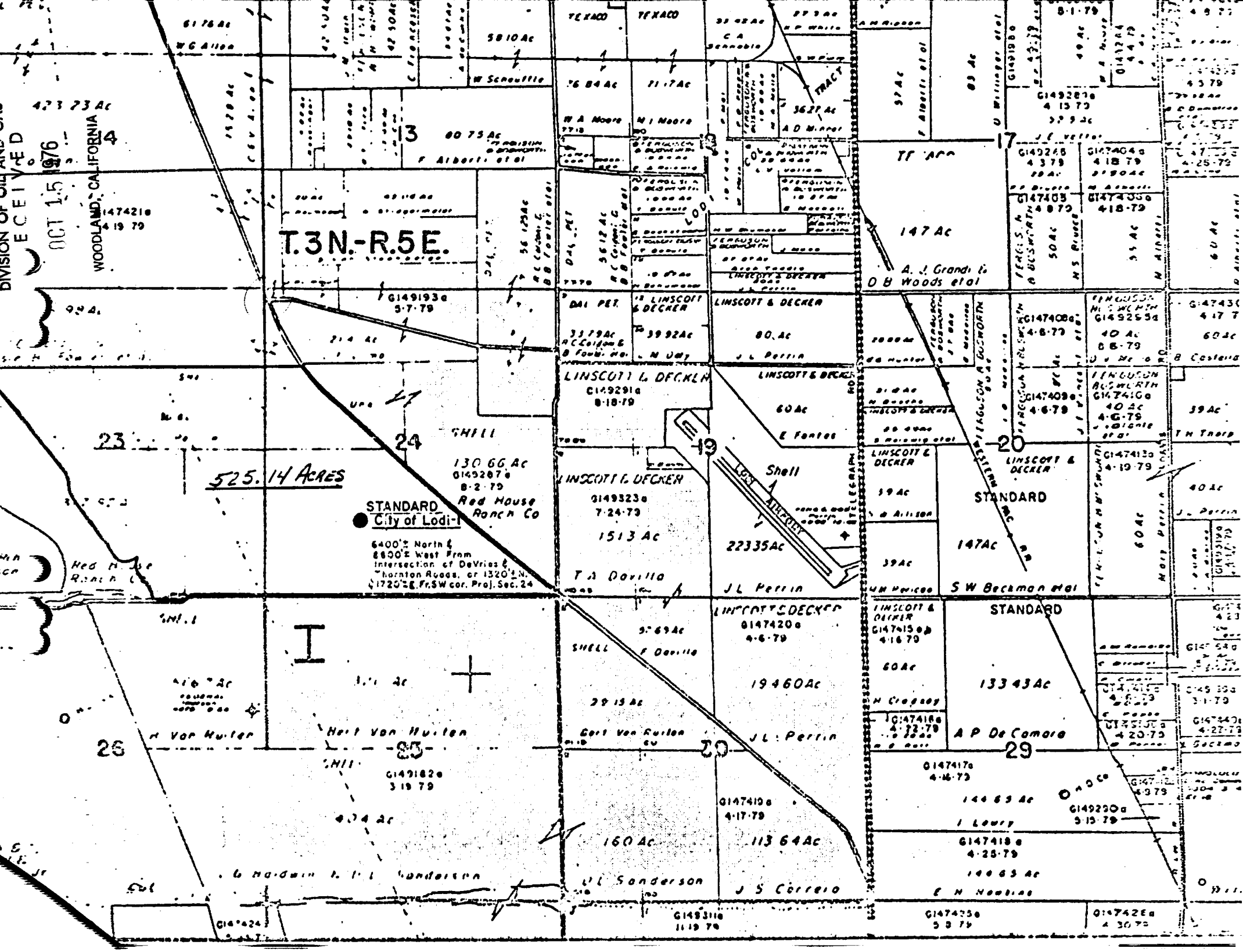
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
	JR 10-19-76	✓	✓	✓	✓

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address 1011 Gateway West-Century City
Los Angeles, California 90067
Telephone Number (213) 879-0666

Great Basins Petroleum Co. (Name of Operator)
By C. W. Hatten, President
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

077-20290


T.3N.-R.5E.
525.14 ACRES
STANDARD
City of Lodi
6400'± North &
6600'± West From
Intersection of DeVries &
Thornton Roads, or 1320'± N.
& 1720'± E. Fr. SW cor. Proj. Sec. 24
Red House Ranch Co
130.66 Ac
G149287a
8-2-79
G149193a
5-7-79
G149291a
8-18-79
G149323a
7-24-79
G149182a
3-19-79
G147420a
4-6-79
G147419a
4-17-79
G147417a
4-16-79
G149220a
3-15-79
G147418a
4-25-79
G147415a
4-16-79
G147416a
4-23-79
G147404a
4-18-79
G147405
4-8-79
G147408a
4-6-79
G147409a
4-6-79
G147413a
4-19-79
G149253a
8-6-79
G149283a
4-15-79
G149268
4-3-79
G147421a
4-19-79
G149119
1-19-79
G147425a
5-3-79
G147426a
4-30-79
LINSCOTT & DECKER
TEXACO
SHELL
Shell
STANDARD
TF Arp
147 Ac
A. J. Grandi & D B Woods et al
S W Beckman et al
133.43 Ac
A P De Comoro
144.63 Ac
I Lowry
144.63 Ac
E N Hoskins
19460 Ac
22335 Ac
113.64 Ac
160 Ac
J S Correia
J L Perrin
T A Dovilla
Gert Von Hurlen
Herl Von Hurlen
H Von Hurlen
W Schouffle
F Albertis et al
WOODLAND, CALIFORNIA
DIVISION OF OIL AND GAS
RECEIVED
OCT 15 1976

DIVISION OF OIL AND GAS
RECEIVED
OCT 15 1976
WOODLAND, CALIFORNIA

Legal Description
of Lease for
Std. - City of Lodi #1 Well

Beginning at the Southeast corner of Section 24, Township 3 North, Range 5 East, Mount Diablo Base & Meridian; thence North 49° 48' West, along the Westerly right-of-way line of THORNTON ROAD to the point of intersection with the North line of the Southwest Quarter of said Section 24; thence continuing North 49° 48' West along said Westerly right-of-way line, 1165.20 feet; thence Northwesterly along said Westerly right-of-way line on a curve to the right through a central angle of 12° 39' 30"; radius of 3584.02 feet, arc length of 783.86 feet to the end of curve; thence South 89° 54' 30" West along the North line of that certain tract of land acquired by George W. Emde, et al, from Clyde O. Fox, by deed filed October 24, 1944 in Book of Official Records, Volume 902, Page 84, said line being on the South line of the land known as Tredway Ranch, 3660.40 feet; thence continuing South 89° 54' 30" West, along the North line of property acquired by George W. Emde, et al, from Lulu F. Bunds by deed filed June 19, 1944 in Volume 887 of Official Records, Page 19, San Joaquin County Records, 1017.00 feet; thence South 89° 58-1/2' West along said North line 2476.40 feet to the Northwest corner of said property acquired by George W. Emde, et al, being on the Easterly line of a 30-foot ditch being also on the Easterly line of the land known as Crawford Ranch; thence following said Easterly line, being also

the Westerly line of said property acquired by George W. Emde, et al, on the following courses and distances: South 27° 04' East, 1762.00 feet; South 61° 01' East, 600.00 feet; South 55° 11' East, 1200.00 feet; South 55° 59' East, 600.00 feet; South 42° 07' East, 300.00 feet; South 2° 09' East, 806.10 feet, to the South line of said Section 23; thence Easterly, along the South line of said Section 23 and the South line of Section 24 to the point of beginning.

EXCEPTING FROM the above parcel all that certain land as described in a deed from City of Lodi to the State of California as recorded in the Office of the County Recorder of San Joaquin County, California, on May 15, 1968 in Book 3209 of Official Records at Page 268, Instrument No. 21018.

ALSO EXCEPTING FROM the above parcel all that certain land as described in a deed from City of Lodi to the State of California as recorded in the Office of the County Recorder of San Joaquin County, California, on April 14, 1970, in Book 3384 of Official Records, at Page 1, Instrument 13775.

Containing 525.14 acres more or less.

DIVISION OF OIL AND GAS
RECEIVED
OCT 15 1976
WOODLAND, CALIFORNIA

DIVISION OF OIL AND GA
RECEIVED
OCT 15 1976
WOODLAND, CALIFORNIA

GREAT BASINS PETROLEUM CO.

PROCEDURE FOR DRILLING
EXPLORATORY WELL
October 4, 1976
STD - CITY OF LODI #1
LODI OPTION PROSPECT

SEC 24, T. 3N., R. 5E., SAN JOAQUIN COUNTY, CALIFORNIA

Well Name: STD - City of Lodi #1

Location: 1320' N & 1728' E of the SW Corner of Sec. 24, T. 3N., R. 5E., MDB&M, San Joaquin County, California. From a geographical standpoint, the well location is 2 miles south and $\frac{1}{4}$ mile west of the intersection of Kettleman Lane (Route 12) and Thornton Road off of Thornton Road $\frac{1}{4}$ mile and/or $6\frac{1}{2}$ miles SW of the center of Lodi, California.

Elevation: Act. G.L. = 6.7', K.B. = 17'

Proposed T.D.: 6500'

Objectives: The primary objective of this exploratory test is to test a "bright spot" in the Eocene Capay Shale section 4380 - 4530' and Cretaceous 2nd & 3rd Massive sands 5250 - 5700'.

Geologic Tops: The subject test will spud in undifferentiated non-marine Pliocene section and penetrate non-marine Pliocene-Miocene section to 3460'.

Geologic Age	Formation	Est. Drilled Depth
Eocene	Nortonville Shale	3550'
	Domengine Sandstone	3730'
	Capay Shale	4650'
Paleocene	Meganos Gorge	4800'
Cretaceous	2nd & 3rd Massive Sands	5250'
	Starkey Sands	5850'
	T.D. (into 3rd Starkey)	6500'

DRILLING, CASING, CEMENTING & COMPLETION PROGRAM

1. Prepare 8' x 4' circular steel cellar. Set and cement 16" x $\frac{1}{4}$" wall conductor 40' below ground level.

2. Move in rig and drill $12\frac{1}{4}$" hole 675' - 717' - ±42'. Depth dependent on casing length on location. In this surface hole, for mud treatment use bentonite, phosphate and water to maintain ±72 PCF, 50 Vis.

3. Cement new 8-5/8" - 24# H-40 ST&C using a guide shoe and insert fill-up collar 1 joint above the guide shoe. Also, install 4 turboblade centralizers 1-10' above the guide shoe and one at the top of the second, fourth, and sixth joints. Cement the 8-5/8" to surface casing using 200 sacks API class "G" cement containing 2% gel and 2% Calcium chloride (268 CF Slurry) calculated on a 37.5% excess, plus 125 sacks API class "G" with 2% $CaCl_2$ only. Continuously move the pipe during displacement. W.O.C. at least 4 hours before releasing the casing and 12 hours before drilling out under the shoe. Cut-off the 8-5/8" such that the top of the 10"x 900 head will be at ground level. This means csg will prob. have to be cut off 5' below ground at abd.

4. Install 10" - 3000 PSI W.P. double ram and Hydril B.O.P.E. with dual station hydraulic controls. Pressure test B.O.P.E. to 1000 PSI.

5. A. Drill 7-7/8" hole 675'± to 6500'. Commence mud logging out from under surface pipe. Prepare three sets of washed samples and three sets of unwashed samples at 30' intervals commencing at ± 3500'.

   B. Maintain at least a 72 PCF mud 675 - 3500'; vis. 40-45 sec. with no specific fluid loss control to 3500'. For mud treatment use bentonite, phosphate and water to maintain mud properties. Make a wiper run every 500' or 6 hours whichever comes first from 675'± to 6500'±. Take deviation surveys at least every 500' and on bit changes.

   When flowline temperature reaches 100-105° F (± 5000'), break over the mud system to a lightly treated lignosulfonate-lignite treatment targeting for a 10 cc or less F.L., 40-45 vis by adding $1\frac{1}{2}$ #/Bbl of lignosulfonate, $1\frac{1}{2}$ #/Bbl of lignite & $\frac{1}{2}$ #/Bbl of caustic. Adjust mud weight to 74-78 PCF as necessary based on hole conditions and as necessary to retard background gas to 35-50 units.

   C. While tripping, continuously circulate thru the fill-up line, constantly observing the pit level for any gains.

   D. Prior to circulating any drilling breaks up, shut-down first & check for flow for 5-10 minutes by observing flowline. If no flow, commence with circulating drilling breakout. If flow is observed, close B.O.P.E. & procede with shut-in & kill procedure.

E. In the event of any gas or well control problems, immediately commence circulating through the blowdown-circulating line and mixing barite if necessary. Never completely close-in the well, unless absolutely necessary, due to the extreme likelihood of rupturing around the surface pipe.

350'± sacks of barite should be maintained on location at all times. It is not desirable to close the well completely in due to the shallow depth of the surface pipe due to the possibility that excessive shut-in pressure could rupture the casing shoe and cause a rupture on the out-side to surface, thereby causing complete loss of well control.

If in the weighing up and circulating process, it appears well control is in a precarious situation, do not procrastinate about calling out cement trucks with at least 500 sacks API class "G" with 2% $CaCl_2$. A first alternative to cementing though would be to attempt to pump in a 50-100 Bbl pill of 120 PCF mud.

6. Run the (1) dual induction - laterolog with 2" linear correlation and 5" logrithmic correlation. Use 10 millivolt SP, 0-30 ohm scale and 0-1000 conductivity scale and (2) BHC integrated sonic with SP. If a completion proves justified to this point and/or is questionable, run:

A. compensated neutron-density log with gamma

B. dipmeter

Note: All logs to be taped. The tapes to be promptly transported to Schlumberger's Century City office for immediate computor analysis.

7. If a completion is not justified, hang open-ended drill pipe 100' below the base of the fresh water sands (estimated @ 2000') and equalize a 75 sack plug of API class "G" cement with 2% $CaCl_2$. Calculated to fill 250 lineal feet. P.O.H. laying down drill pipe. Equalize a 75 sack plug, hanging 50' below the shoe 9-5/8" casing @ ±675' bringing cement back to at least 50 into 8-5/8" shoe. D.O.G. to witness top of plug @ 625'. With drill pipe hanging at 93', equalize a 50 sack plug of API class "G" cement. Release rig.

does this check out

COMPLETION

1. If a completion is justified, a 4½" - 10.5 & 11.6# K-55 ST&C casing string will be run if a single zone completion exists or a 5½" - 15.5 & 17# K-55 ST&C casing string will be run if a dual completion is forthcoming. Cement the completion string to surface using a pozmix filler cement from 1000' above any potential zone to surface and neat cement from T.D. to 1000' above any potential zone. Use turboblade centralizers every other joint through, and 180' above and below any zone. Use Howco type differential fill-up collar and differential guide shoe. Install tubing spool. Install 6" - 900 B.O.P.E.

Single Zone Completion Procedure

1. Pick-up 2-3/8" tubing with 3¼" collars and C.O. 4½" casing to 10'+ below any future proposed performations. Run CBL and gamma-collar correlation log. Close rams and pressure test 4½" casing to 2500 PSI after running CBL log. Perforate 4½" holes above all proposed zones and test for W.S.O. as required for D.O.G. Circulate out the drilling mud with water. Rerun and land open-ended tubing with pump shoe ±50' above all major proposed performation intervals, within reason. After installing tubing bonnet, repressure test casing and tubing head to 2,500 PSI.

2. Displace water I.H. with nitrogen, depressing the F.L. 1500' downhole. Rig up 3,000 W.P. grease injector lubricator and perforate the proposed intervals through tubing and underbalanced, using 1-3/4" Magnum Swing Jet.

3. Flow test and evaluate well. Release rig.

Dual Zone Completion Procedure

1. Pick-up 2-3/8" tubing with 3¼" collars, bit and scraper and C.O. 5½" casing to 10+ below any future proposed perforations. Run CBL, gamma-collar correlation log. Close rams and pressure test 5½" casing to 2500 PSI after running CBL log. Perforate 4½" holes above all proposed zones and test using dry tester as required for D.O.G. Perforate 4½" holes above the lower most zone and W.S.O. Circulate the drilling mud O.H. with ±75 PCF clean salt water containing 3% by weight of KCL. Across the interval to be perforated, spot a pill containing 1 PPB of X-C polymer.

2. Set a Baker Model "FB-1 packer" with 3.000" bore with 10' tail with 1.81' seating nipple below the packer.

3. Perforate the upper interval with 4½" H/F using 4" O.D. casing gun.

4. Hydrotest 2-3/8" tubing I.H. with seal assembly and model "L" sliding sleeve ±10' above seal assembly. Model "L" to contain 1.87' seating nipple. Blast joints to be installed 10' above and below perforated interval.

5. Land tubing in packer and pressure test seal assembly and tubing to 2500 PSI. Install Christmas tree and retest tubing, tree and seal assembly when installed. Test to 2500 PSI between donut and bonnet to test tubing spool-tree connection.

6. Open sliding sleeve and circulate completion fluid out of the tubing and casing with nitrogen to bring on the annulus zone. Continuously inject nitrogen until no solids content is observed to prevent a solids bridge from occurring in the annulus.

7. Close sliding sleeve once zone is cleaned-up. Bleed-off tubing pressure to determine if sliding sleeve closed properly.

8. Rig up 3000 PSI W.P. grease injector lubricator onto tubing and perforate the proposed lower intervals through tubing and underbalanced using conventional 1-9/16" x 4-5/8" Swing Jet.

9. Flow test and evaluate tubing side completion.

Joe Kandle

Joe Kandle

Note: Billing address is as follows:

GREAT BASINS PETROLEUM CO.
1011 Gateway West - Century City
Los Angeles, California 90067

Use only Teflon Pipe dope on all casing, tubing and completion connections.

DUPLICATE LOGS TO ARCHIVES

Schlumberger

DUAL INDUCTION - LATEROLOG
WITH LINEAR CORRELATION LOG

COUNTY LODI FIELD LOCATION WELL CITY OF LODI NO. 1 COMPANY GREAT BASINS PET. CO.

COMPANY GREAT BASINS PETROLEUM COMPANY

077-20290

WELL " CITY OF LODI " ~~NO.~~ 1

FIELD ~~LODI WEST~~

COUNTY SAN JOAQUIN STATE CALIFORNIA

LOCATION 1320' NORTH & 1728' EAST OF THE SOUTHWEST CORNER

API SERIAL NO	SEC	TWP	RANGE
	24	3N	5E

Other Services: BHC

Permanent Datum: GL ; Elev.: 7

Log Measured From KB 10 Ft. Above Perm. Datum

Drilling Measured From KB

Elev.: K.B. 17 D.F. -- G.L. 7

Date	11/29/76	Event 3 & 4 information		
Run No.	ONE			
Depth—Driller	6624			
Depth—Logger	6709			
Btm. Log interval	6703			
Top Log interval	738			
Casing—Driller	8 5/8" @ 740	@	@	@
Casing—Logger	738			
Bit Size	7 7/8"			
Type Fluid in Hole	LIGNOSULFONATE			
Dens. / Visc.	75 / 50			
pH / Fluid Loss	10 / 8 ml	ml	ml	ml
Source of Sample	FLOWLINE			
Rm @ Meas. Temp.	6.8 @61 °F	@ °F	@ °F	@ °F
Rmf @ Meas. Temp.	6.25 @54 °F	@ °F	@ °F	@ °F
Rmc @ Meas. Temp.	4.09 @65 °F	@ °F	@ °F	@ °F
Source: Rmf / Rmc	M / M			
Rm @ BHT	3.0 @138 °F	@ °F	@ °F	@ °F
Time Circulation Stopped	1330			
Time Logger on Bottom	1715			
Max. Rec. Temp.	135 °F	°F	°F	°F
Equip. Location	7763 SAC			
Recorded By	ANDERSON			
Witnessed By	[illegible]			

DIVISION OF OIL AND GAS
RECEIVED
DEC 20 1976
WOODLAND, CALIFORNIA

The well-name, location and borehole reference data were furnished by the customer.

SCALE CHANGES		
Type Log	Depth	Scale Up Hole / Scale Down Hole

REMARKS

Run No.	ONE
Service Order No.	04269
Fluid Level	FULL
Salinity - PPM Cl.	---
Speed - F.P.M.	100

EQUIPMENT DATA	
Panel No.	BA 293
Cart No.	B 264
Sonde No.	DB 306
Mem. Panel No.	DC 478
G.R. Panel No.	---
G.R. Cart. No.	---
Tape Recorder - (TTR)	---
Depth Encoder - (DRE)	---
Pressure Wheel (CPW)	---
Type Centralizers	---
Stand Off - Inches	1 1/2"

CALIBRATION DATA	
Sonde Error - ILM	---
Sonde Error - ILD	---
G.R. BKG. - CPS.	---
G.R. Source - CPS	---

LOGGING DATA	
S.E. Log - ILM	---
S.E. Log - ILD	---
S.E. - Set in Hole - Depth	---
S.E. Corr. - Hole Size	---
G.R. Scale per 100 Div.	---
G.R. - T.C.	---
G.R. Sens.	---

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

CONDUCTIVITY — MILLIMHOS/M = 1000 / OHMS M²/M — DEEP INDUCTION — 0 — 1000

RESISTIVITY — OHMS M²/M — DEEP INDUCTION — 0 — 30

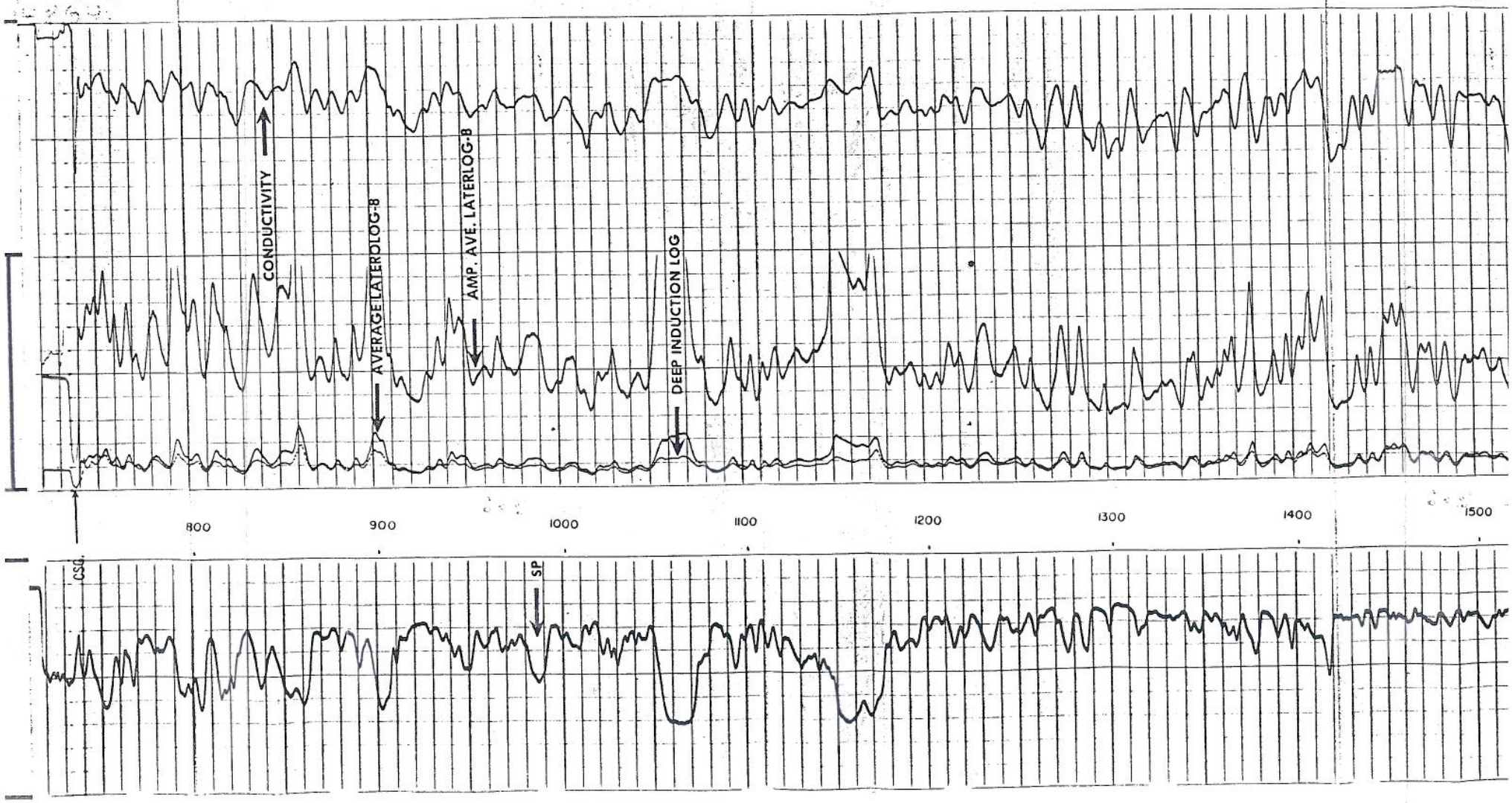
0 — 300 — AVERAGED LATEROLOG-8

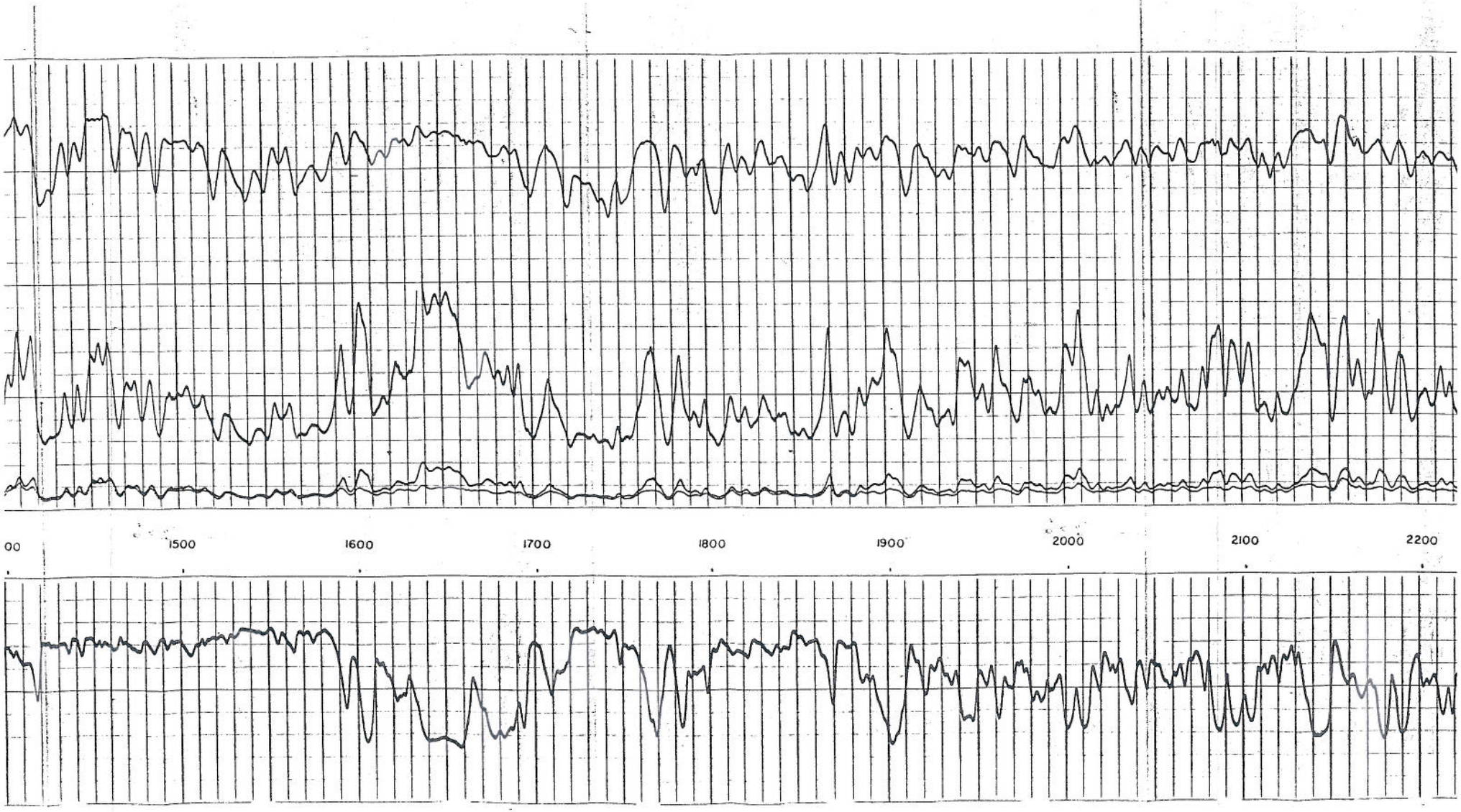
0 — 30

0 — 300 — AMP. AVE. LATEROLOG-8

0 — 6

SPONTANEOUS-POTENTIAL — MILLIVOLTS — -10 — +


CONDUCTIVITY
AVERAGE LATERLOG-8
AMP. AVE. LATERLOG-B
DEEP INDUCTION LOG
800
900
1000
1100
1200
1300
1400
1500
CSG.
SP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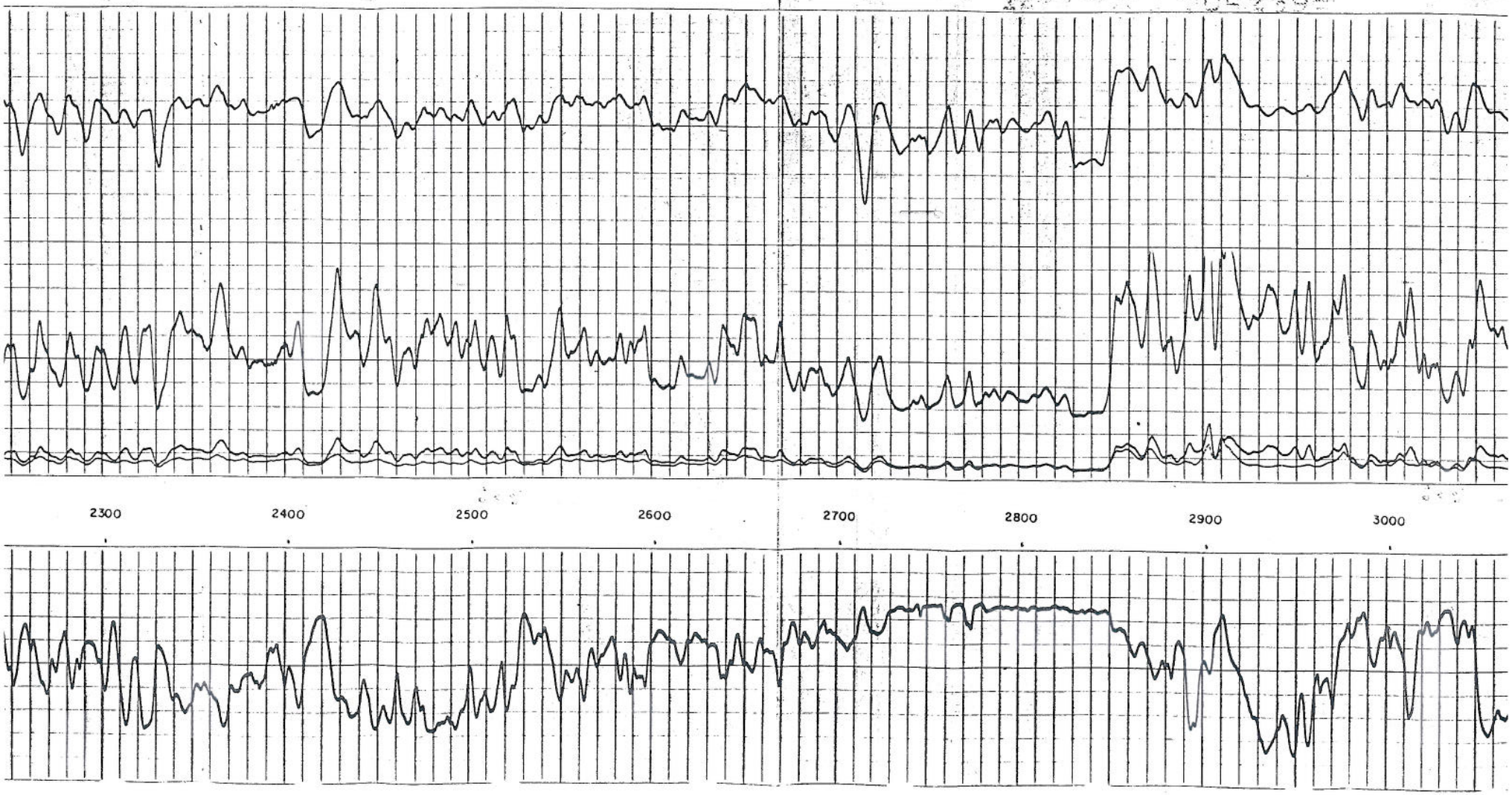
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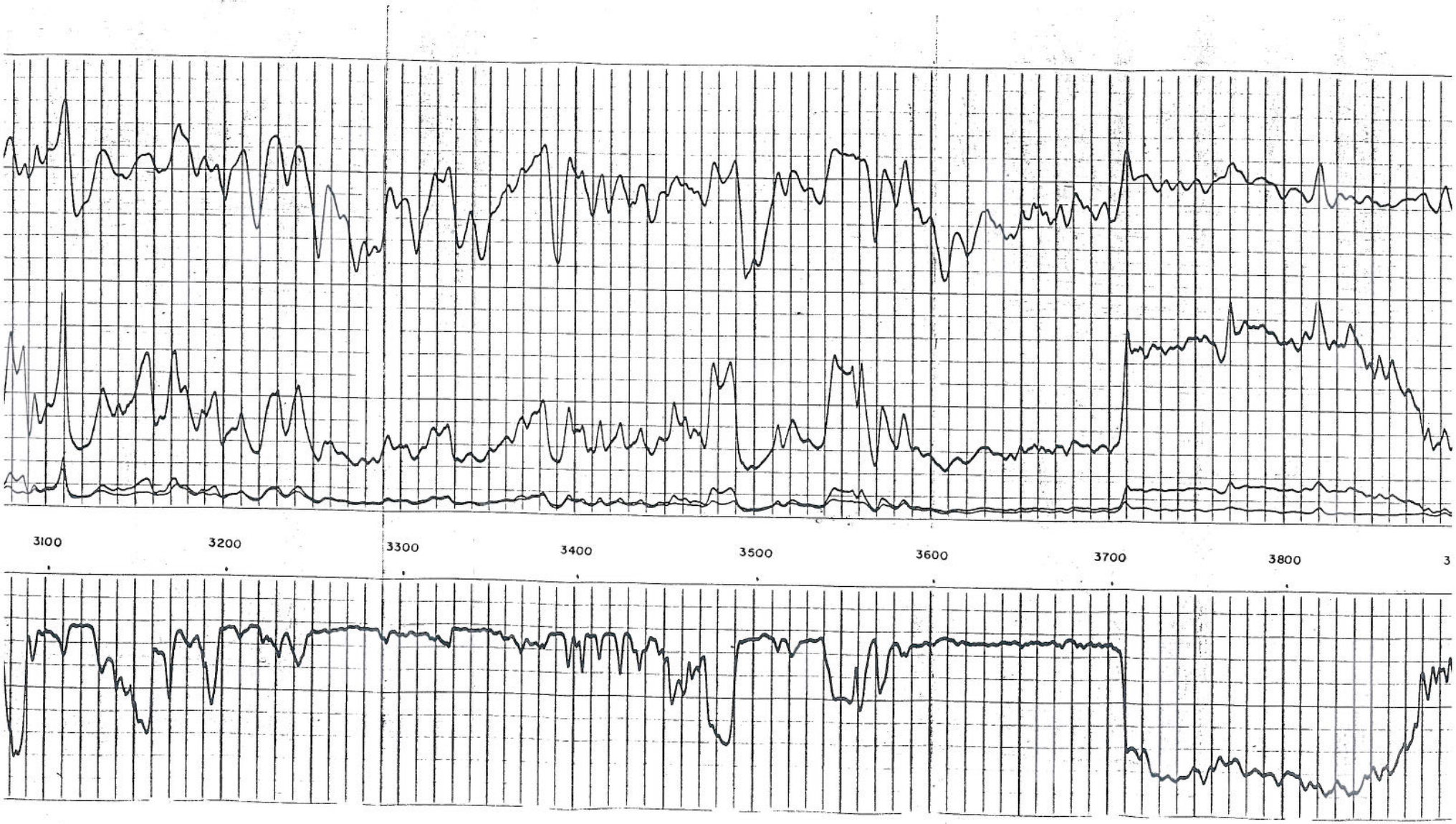
2600
2700
2800
2900
3000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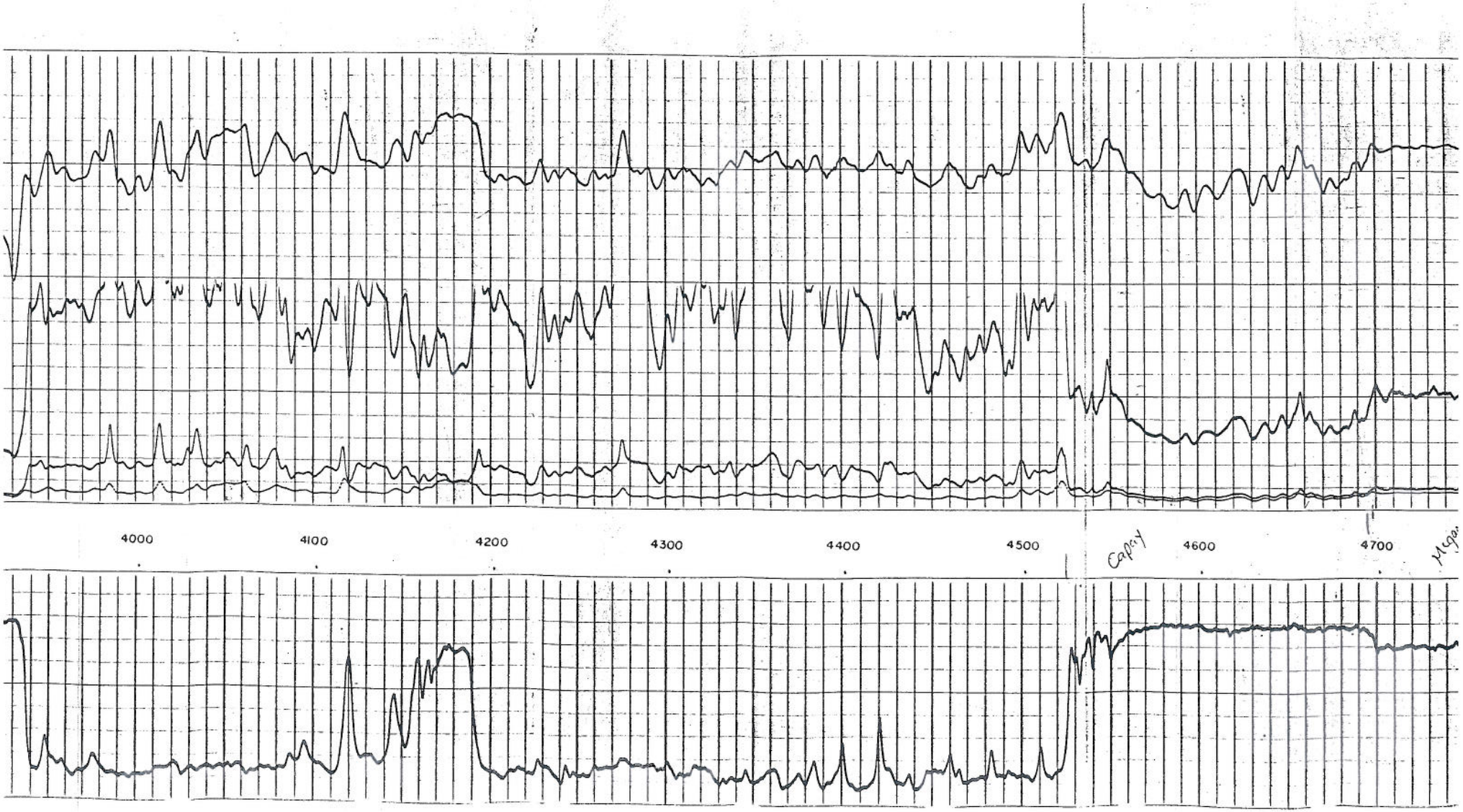
3500
3600
3700
3800
3


4000
4100
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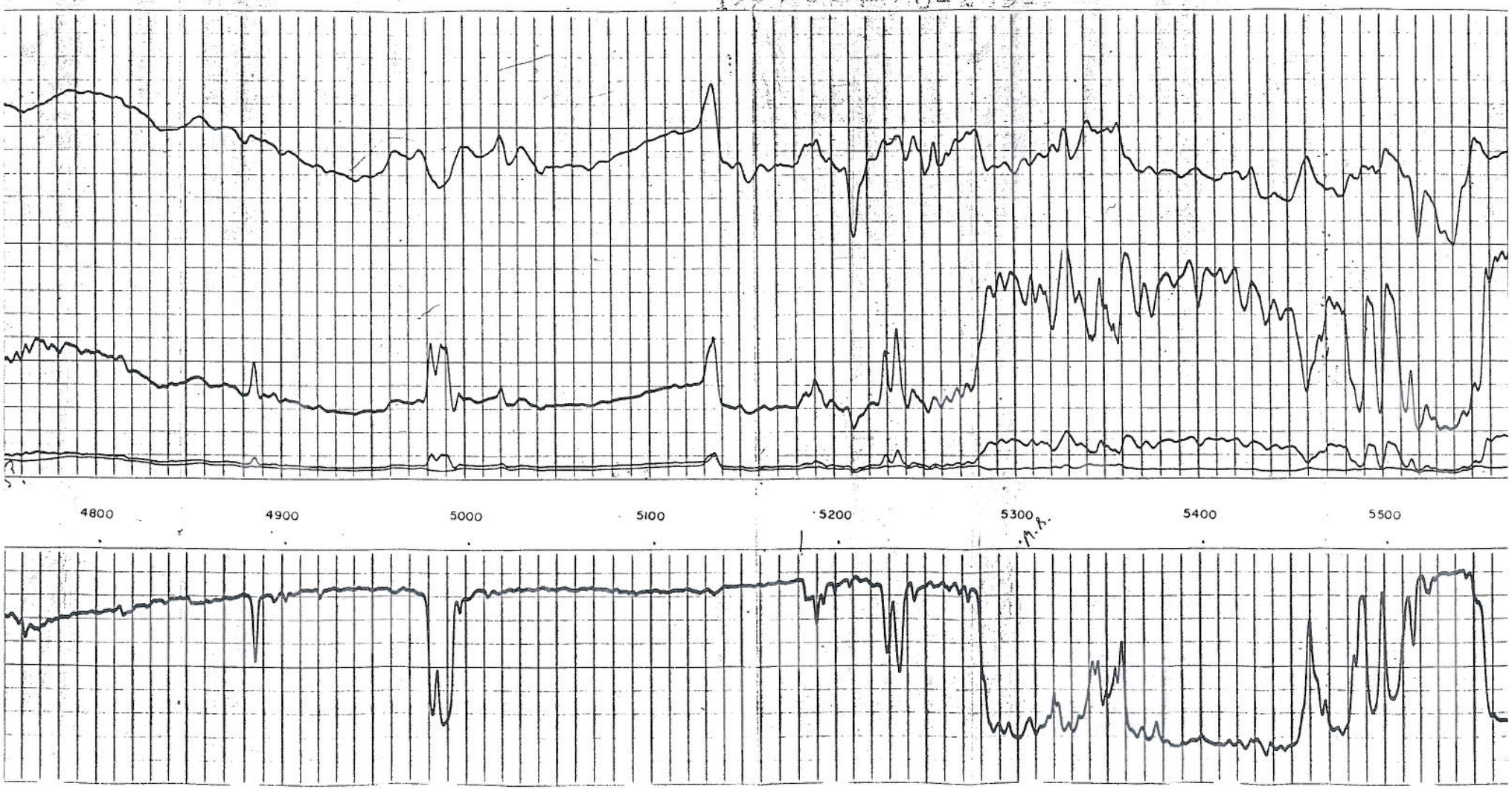
4300
4400
4500
Capacity
4600
4700
Mega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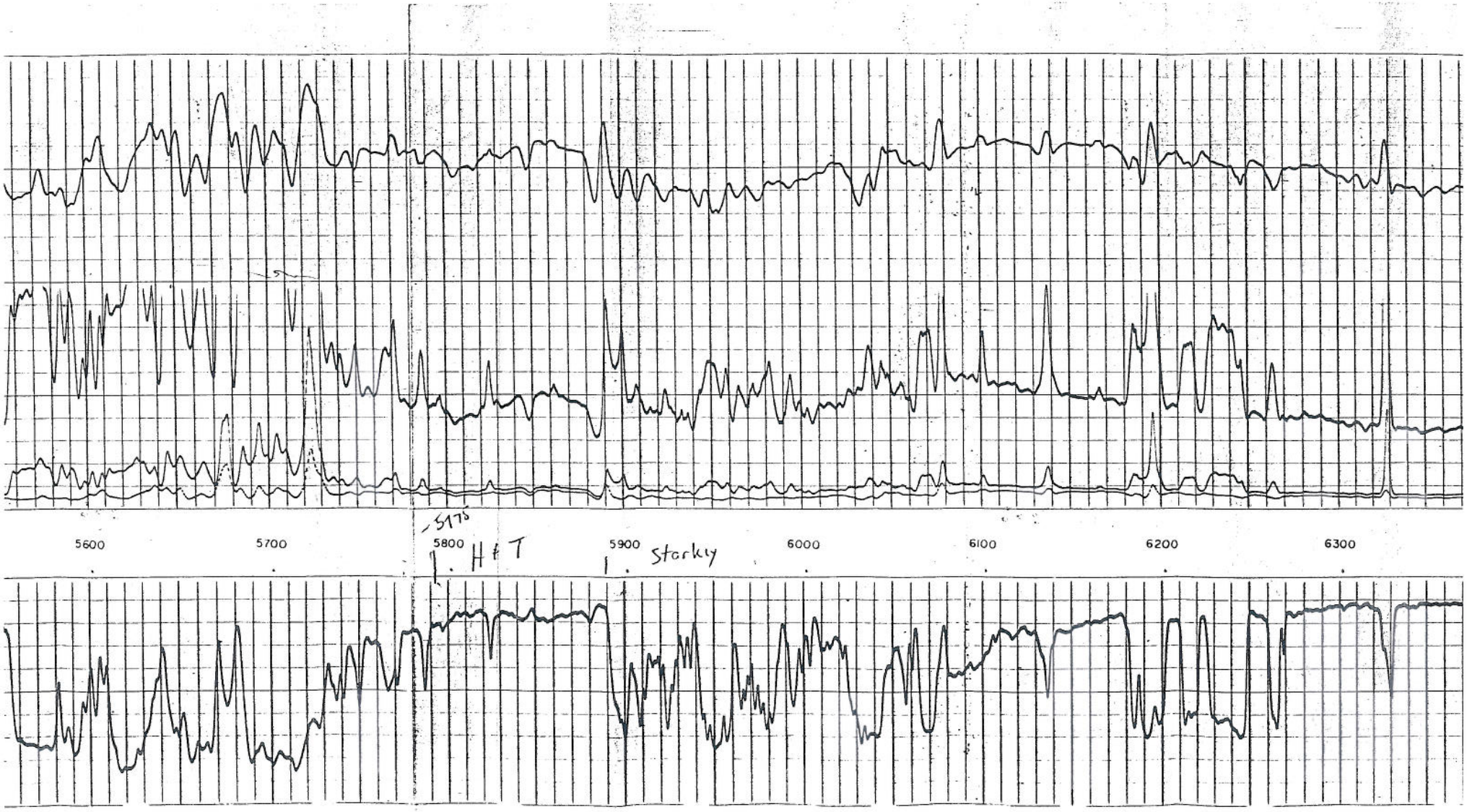
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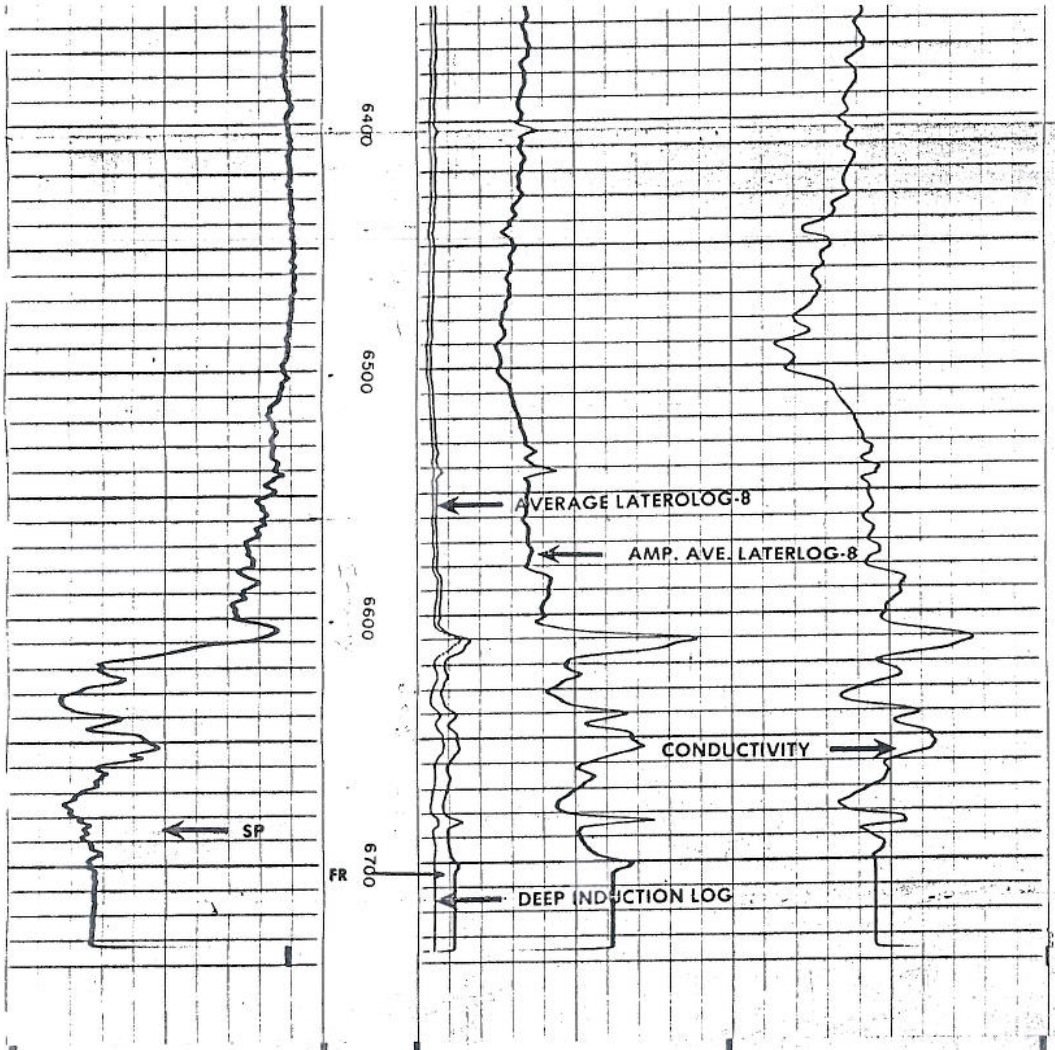
6300
H & T
Starkey



RESISTIVITY OHMS M²/M

AVERAGE LATEROLOG-8

0 — 30

0 — 300

DEEP INDUCTION

0 — 30

0 — 300

AMPLIFIED AVE. LATEROLOG — 8

0 — 6

CONDUCTIVITY MILLIMHOS/M = $\frac{1000}{\text{OHMS M}^2/\text{M}}$

DEEP INDUCTION

1000 — 0

SPONTANEOUS-POTENTIAL

− 10 + MILLIVOLTS

DEPTHS

COMPANY GREAT BASINS PETROLEUM COMPANY

WELL CITY OF LODI NO. 1

FIELD LODI WEST

COUNTY SAN JOAQUIN STATE CALIFORNIA

SCHL. FR 6703

SCHL. TD 6709

DRLR. TD 6694

Elev: KB 17

DF - -

GL 7

Red House Fee #65-24
API No. 07720496

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, California

February 23, 1988

Mr. Andy Hauge, Agent
MAXUS EXPLORATION COMPANY
c/o QUAD CONSULTANTS
1919 21st Street, Suite 209
Sacramento, CA. 95814

Your report of abandonment of well "Red House Fee" 65-24 (Name and number),

A.P.I. No. 077-20496, Section 24, T. 3N, R. 5E, M.D. B. & M.,

---- field, San Joaquin County,

dated 9/24/87, received 1/22/88, has been examined in conjunction with records filed in this office, and we have determined that all of the requirements of this Division have been fulfilled.

Environmental inspection made and approved 8/1/87.

MFC/sd
Blanket Bond
CONFIDENTIAL STATUS

M. G. MEFFERD
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

OG159 (11/82/GSR1/8M)

DIVISION OF OIL AND GAS

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company Maxus Expl. Co. Well No. "Red House Fee" 65-24

API No. 077-20496 Sec. 24, T. 3N, R. 5E, MD B.&M.

County San Joaquin Co. Field —

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	1-22-88
History (Form OG103)	✓
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs: 2 DIL/Sonic	2" 5" 1-6-88
Dip	5" ✓
Dipmeter	5" 1-28-88

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Waterflood	___
Abandoned - Oil	___	Steamflood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	___	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Gas Storage	___	Waterflood Source	___

DATE RECOMPLETED ____ "E" well Yes ☐ No ☐

REMARKS ____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports ✓
10. Casing Record ✓
11. Plugs ✓
12. Surface Inspection 8-1-87
13. Production
14. E Well on Prod., enter EDP
15. Directional Survey

CLERICAL CHECK LIST

1. Location change ____ (F-OGD165) ____
2. Elevation change ____ (F-OGD165) ____
3. Form OGD121 ✓
4. Form OG159 (Final Letter) ____
5. Form OGD150b (Release of Bond) ____
6. Duplicate logs to archives ____
7. Notice of Records due (F-OGD170) ____
8. EDP (F-OGD42A-1, 2) ____

cert expires 7-8-89

RECORDS NOT APPROVED

Reason: ____

RECORDS APPROVED RT 1-26-88

FINAL LETTER

RELEASE BOND ____

Date Eligible ____

(Use date last needed records were received.)

MAP AND MAP BOOK ____

(87-5762)

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (8/87/DWRR/5M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

RECEIVED JAN 22 1988 WOODLAND, CALIFORNIA

API No. 077-20496

Operator: Maxus Exploration Company	Well: Red House Fee 63-24
Field:	County: San Joaquin; Sec. 24; T. 3N; R. 5E; B.&M. M.D.
Location (Give surface location from property or section corner, street center line and/or California coordinates): 2300' North, 1800' West of Southeast corner of Sec. 24	Elevation of ground above sea level: 9.2'

Commenced drilling (date): 7/1/87

Completed drilling (date): 7/8/87

Commenced producing (date):

☐ Flowing ☐ Pumping
☐ Gas lift

Name of producing zone(s): Plug & Abandon

Total depth: (1st hole) 5762'; (2nd) -----; (3rd) ----

Present effective depth: Plugged and abandoned

Junk: None

Depth measurements taken from top of: ☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing

Which is 9.5 feet above ground

GEOLOGICAL MARKERS	DEPTH
Domengine	3670'
Capay	4055' x
Mokelumne River	4653'
H&T Shale	5695'

Formation and age at total depth: H&T Shale

	Clean Oil (bbl per day)	Gravity Clean Oil	Percent Water including emulsion	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production	P & A					
Production After 30 days						

CASING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New or Second Hand	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)
8 5/8"	0	605	24#	K-55	New	12¼"	321 sxs.	Surface

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Plug and abandon

Was the well directionally drilled? If yes, show coordinates at total depth

☐ Yes ☒ No

Electrical log depths: T.D. 5764'

Other surveys:

In compliance with Sec. 3215, Division 3 of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name: Caleb B. Leake	Title: Asst. Dist. Drlg. Supt.
Address: P.O. Box 2530	City: Mills, Wyoming; Zip Code: 82644
Telephone Number: 307/266-1882	Signature: Caleb B. Leake; Date: 1/18/88

OG100 (12/83/DWRR/5M)

SUBMIT IN DUPLICATE

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

RECEIVED
JAN 22 1988
WOODLAND, CALIFORNIA

History of Oil or Gas Well

Operator Maxus Exploration Company **Field** ..... **County** San Joaquin
Well Red House Fee 65-24, **Sec.** 24, **T** 3N, **R** 5E, MD **B. & M.**
A.P.I. No. 077-20496 **Name** Caleb B. Leake (Person submitting report) **Title** Asst. Dist. Drlg. Supt (President, Secretary or Agent)
Date 1-18, 19 88.

Signature Caleb B. Leake

P.O. Box 2530 Mills, Wyoming 82644 (Address) 307/266-1882 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date	
7/1/87	Spud well at 10:00 A.M. Drill 12¼" hole to 605'. Run 15 jts. of 8 5/8", 24#, K-55, ST&C casing to 605'. Cement casing with 321 sxs. cement. WOC. Cut off and weld on head.
7/2/87	NU BOP and test BOPE. Drill 7 7/8" hole
7/7/87	Drill 7 7/8" hole to T.D. of 5762'. Log.
7/7/87	Set plugs to P & A. 1st plug: 655' - 450', 128 sxs.; Surface plug 10 sxs.
7/8/87	ND BOPE. Weld on plate to surface casing. Release rig at 11:00 A.M.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 687-158

DIVISION OF OIL AND GAS

Report on Operations

Andy Hauge, Agent
MAXUS EXPLORATION CO.
c/o QUAD CONSULTANTS
1919 21st St., Suite 209
Sacramento, CA. 95814

Woodland Calif.
July 9, 1987

Your operations at well "Red House Fee" 65-24, API No. 077-20496, Sec. 24, T. 3N, R. 5E, M.D. B.& M. ---, Field, in San Joaquin County, were witnessed on 7/8/87. M. Cummings, representative of the supervisor, was present from 0400 to 0600. There were also present E. Stanley, Drilling Foreman.

Present condition of well: 8-5/8" cem. 605'. T.D. 5762'. Plugged w/cement 650'-360' & 45'-5'.

The operations were performed for the purpose of abandonment.

DECISION: The plugging operations as witnessed and reported are approved.

MC/sd
CONFIDENTIAL STATUS

8/1/87
MFC

M. G. MEFFERD

By John C. Sullivan
John C. Sullivan

OG109 (3/83/GSR1/15M)

DIVISION OF OIL AND GAS
Cementing/Plugging Memo

Operator [illegible] Well No. "Red House Fee" 65-24
API No. [illegible] Sec. 24, T. 5N, R. 5E, MD B&M
Field _____, County San Juan. On 7/8/87,
Mr. N. Cummings, representative of the supervisor was present from 0400 to 0600.
There were also present Ed Stanley - DF
Casing record of well: 8 5/8" csg 605', TD 5762', Plugged w/cement 650'-360'
45'-5'

The operations were performed for the purpose of ABANDONMENT

☒ The plugging/~~cementing~~ operations as witnessed and reported are approved.

☐ The location and hardness of the cement plug @_____' is approved.

Hole size:_____" fr._____' to_____', _____" to_____' & _____" to_____'

Casing				Cemented			Top of Fill		Squeezed Away	Final Press.	Perfs.
Size	Wt.	Top	Bottom	Date	MD-Depth	Volume	Annulus	Casing			

Casing/tubing recovered:_____" shot/cut at_____', _____', _____' pulled fr._____';
_____" shot/cut at_____', _____', _____' pulled fr._____'.

Junk (in hole):_____

Hole fluid (bailed to) at_____'. Witnessed by_____

Mudding	Date	Bbls.	Displaced	Poured	Fill	Engr.

Cement Plugs		Placing	Placing Witnessed		Top Witnessed			
Date	Sx./cf	MD & Depth	Time	Engr.	Depth	Wt/Sample	Date & Time	Engr.
7/8	[illegible]	[illegible] 650	—	—	360	DP	7/8 0500	MFC
	10 [illegible]	DP [illegible]	0600	MFC	15 ✓	VISUAL	✓ 0600	MFC

OGD 10 (10/86/DWRR/5M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 687-451

PERMIT TO CONDUCT WELL OPERATIONS

--- (field code)
--- (area code)
--- (new pool code)
--- (old pool code)

Mr. Andy Hauge
MAXUS EXPLORATION COMPANY
c/o QUAD CONSULTANTS
2530 J Street, Suite 302
Sacramento, CA. 95816

Woodland, California
September 29, 1987

Your _____ proposal to abandon well "Red House Fee" 65-24, A.P.I. No. 077-20496, Section 24, T. 3N, R. 5E, M.D. B. & M., --- field, --- area, --- pool, San Joaquin County, dated 9/24/87, received 9/28/87 has been examined in conjunction with records filed in this office.

THE PROPOSAL, COVERING WORK ALREADY COMPLETED IN ACCORDANCE WITH PRIOR AGREEMENT, IS APPROVED.

THIS DIVISION SHALL BE NOTIFIED:

1. To inspect and approve the clean-up of the wellsite before approval of abandonment will be issued.

NOTE:

1.All casings must be removed from at least 5 feet below ground level.

CONFIDENTIAL STATUS
Blanket Bond
MFC/sd

Engineer _____

Phone _____

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (1/85/DWRR/5M)

Abd.
D.H.

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
SEP 28 1987
WOODLAND, CALIFORNIA

Notice of Intention to Abandon Well

FOR DIVISION USE ONLY			
CARDS	BOND	FORMS	
		OGD114	OGD121
✓	66	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3229, Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon well Red House Fee 65-24, API No. 077-20496, Sec. 24, T. 3N, R. 5E, M.D.B. & M., Wildcat Field, San Joaquin County. commencing work on July 1, 1987, 19____.

The present condition of the well is:

1. Total depth 5,762'
2. Complete casing record, including plugs and perforations (present hole)
   40' - 16" conductor
   605' 8 5/8" casing, 24#, K-55
   See plugs below
3. Last produced Plugged and abandoned (Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)

or

4. Last injected N/A (Date) (Water, B/D) (Gas, Mcf/D) (Surface pressure)

Additional data for dry hole (show depths):

5. Oil or gas shows None
6. Stratigraphic markers
   See below
7. Formation and age at total depth
8. Base of fresh water sands 555'

9. Is this a critical well according to the definition on the reverse side of this form? ☐ Yes ☒ No

The proposed work is as follows:

Plugging Procedure:

Depth	Plugs
655' - 450'	128 sxs.
30' - 0'	10 sxs.

Stratigraphic Markers:

Domengine	3,670'
Capay	4,055'
Mokelumn River	4,653'
H & T Shale	5,695'

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address P.O. Box 2530 (Street)
Mills (City) Wyoming (State) 82644 (Zip)
Telephone Number (307) 266-1882 (Area Code) (Number)

Maxus Exploration Company (Name of Operator)
By Odell Williams (Print Name)
Odell Williams (Signature) Sept. 24, 1987 (Date)

OG108 (10/85/DWRR/5M)

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
  (A) Any building intended for human occupancy that is not necessary to the operation of the well; or
  (B) Any airport runway.
(2) 100 feet of the following:
  (A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
  (B) Any navigable body of water or watercourse perennially covered by water;
  (C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
  (D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
221 WEST COURT STREET, SUITE 1
WOODLAND, CALIFORNIA 95695
(916) 662-4683

September 15, 1987

Mr. Andy Hauge, Agent
MAXUS EXPLORATION COMPANY
c/o QUAD CONSULTANTS
2530 J Street, Suite 302
Sacramento, CA. 95816

RE: MAXUS EXPLORATION COMPANY
Wells "Red House Fee" 65-24
"Steffan Fee" 85-1
San Joaquin County, California

Dear Mr. Hauge:

It has been brought to my attention that MAXUS EXPLORATION CO. is long overdo regarding the submission of abandonment notices for the above two wells. Please submit the two Notices of Intention to Abandon (Form OG 108) without additional delay.

For your convenience, a small supply of the necessary form is enclosed.

Yours truly,

John C. Sullivan
Deputy Supervisor

JCS/sd

Enclosure

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 687-146

DIVISION OF OIL AND GAS

Report on Operations

Mr. Andy Hauge, Agent
MAXUS EXPLORATION CO.
2530 J Street, Suite 302
Sacramento, CA. 95816

Woodland Calif.
July 7, 1987

Your operations at well "Red House Fee" 65-24, API No. 077-20496, Sec. 24, T. 3N, R. 5E, M.D. B.& M. --- Field, in San Joaquin County, were witnessed on 7/2/87. M. Cummings, representative of the supervisor, was present from 1700 to 1900. There were also present E. Stanley, Drilling Foreman.

Present condition of well: 8-5/8" cem. 605', T.D. 605'. (Standing Cemented).

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION: The blowout prevention equipment and its installation on the 8-5/8" casing are approved.

NOTE:

1. Deficiencies noted and to be corrected:

   a. Kelly cock would not hold pressure.
   b. No gauge on N_2 bottles.

MC/sd
CC: J. M. Pachulski, WY.
CONFIDENTIAL STATUS

M. G. MEFFERD

By John C. Sullivan
John C. Sullivan

OG109 (3/83/GSR1/15M)

DIVISION OF OIL AND GAS

BLOWOUT PREVENTION EQUIPMENT MEMO

T _____

Operator MAXUS EXPLOR. CO. Well "RED HOUSE FEE" 65-24 Field — County SAN JOAQUIN

VISITS:	Date	Engineer	Time	Operator's Rep.	Title
1st	7/2/87	M. Cummings	1700 to 1900	E STANLEY	DF
2nd			to		

Casing record of well: 8 5/8" cem 605', TD 605. (STANDING CEMENTED)

OPERATION: Testing (~~inspecting~~) the blowout prevention equipment and installation.
DECISION: The blowout prevention equipment and its installation on the 8 5/8 "casing are approved.

REQUIRED BOPE CLASS: III B 2M

Proposed Well Opns: Drilling MPSP: _____ psi
Hole size: _____" fr. _____' to _____', _____" to _____' & _____" to _____'

CASING RECORD (BOPE ANCHOR STRING ONLY)					Cement Details	Top of Cement	
Size	Weight(s)	Grade(s)	Shoe at	CP at		Casing	Annulus
8 5/8	24	K55	605		171 sx 496 Gal 2% CA		RETURNS
					150 sx 2% CA		

BOP STACK							a	b	a/b	TEST DATA			
API Symb.	Ram Sz.	Mfr.	Model or Type	Size (in.)	Press. Rtg.	Date Last Overhaul	Gal. to Close	Rec. Time (Min.)	Calc. GPM Output	psi Drop to Close	Secs. to Close	Test Date	Test Press.
A		Hydril	Bag									7/2	1100
RD		Shaffer	Pipe									✓	1100
RD		✓	Blind									✓	DF

ACTUATING SYSTEM

Accum. Unit(s) Wkg. Press. 1500 psi
Total Rated Pump Output _____ gpm
Distance From Well Bore 60 ft.

	Mfr.	Accum. Cap.	Precharge
1	Hydrill	60 gal.	750 psi
2		gal.	psi

CONTROL STATIONS	Elec.	Hyd.
✓ Manif. at accum. unit		✓
✓ Remote at Drlr's. stn.	✓	
Other:		

EMERG. BACKUP SYST.	Press.	Wkg. Fl.
✓ N2 Cyl No: 3 Type:	1 No	gal.
Other:	2 GAUGE	gal.
	3	gal.
	4	gal.
	5	gal.
	6	gal.

AUXILIARY EQUIPMENT

		No.	Sz. (in.)	Rated Press.	Connections Weld	Flan.	Thrd.	
✓	Fill-Up Line							
✓	Kill Line							
✓	Control Valve(s)							
✓	Check Valve(s)							
	Auxil. Pump Connec.							
✓	Choke Line							
✓	Control Valve(s)							
✓	Pressure Gauge							
✓	Adjustable Choke(s)							
✓	Bleed Line							
	Upper Kelly Cock							
	Lower Kelly Cock							
✓	Standpipe Valve							
✓	Standpipe Pressure Ga.							
✓	Pipe Safety Valve							
✓	Internal Preventer							

HOLE FLUID MONITORING EQUIPMENT	Alarm Aud.	Alarm Vis.	Class
✓ Calibrated Mud Pit			A
✓ Pit Level Indicator	✓	✓	B
✓ Pump Stroke Counter	✓	✓	B
Pit Level Recorder			C
Flow Sensor			C
Mud Totalizer			C
Calibrated Trip Tank			C
Other:			

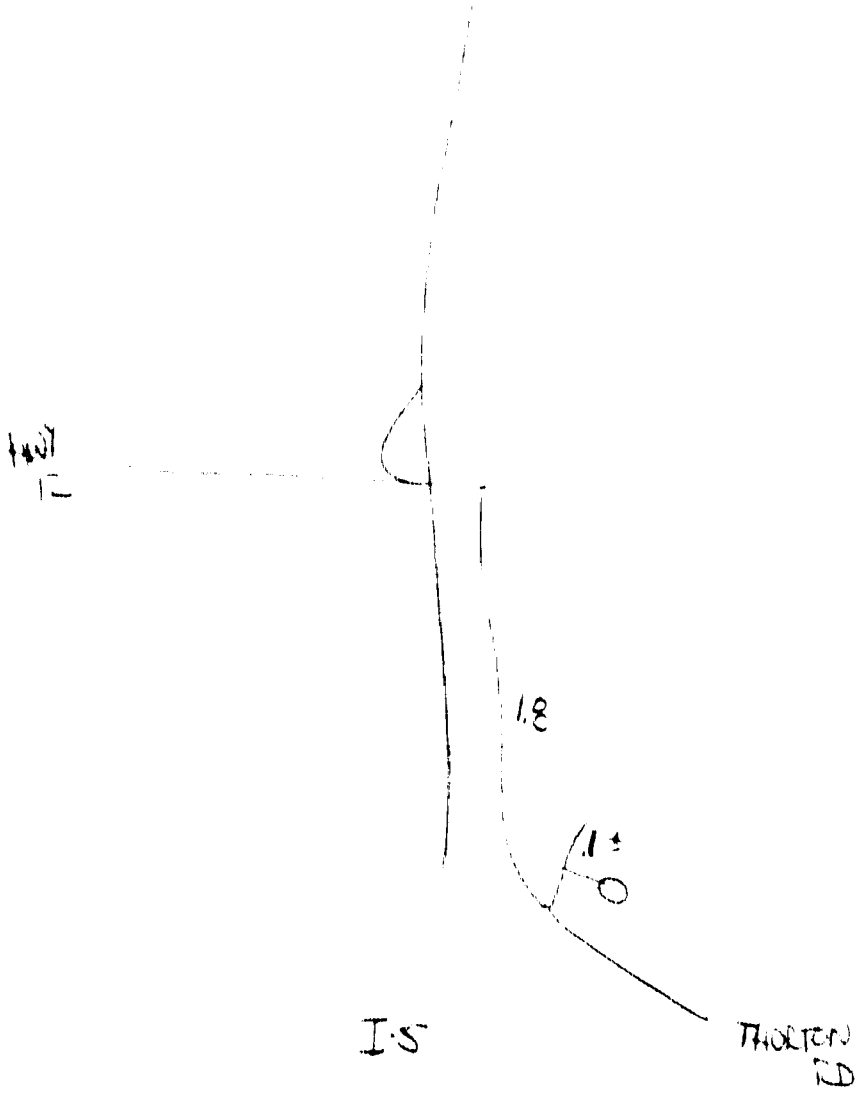
REMARKS:

B) KELLY COCK WOULD NOT HOLD PRESSURE

B) NO GAUGE ON N_2 BOTTLES

Hole Fluid Type	Weight	Storage Pits

OGD9 (3/83/DWRR/3M)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THORTON RD

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 687-266

--
(field code)
--
(area code)
--
(new pool code)
--
(old pool code)

REPORT ON PROPOSED OPERATIONS

WELL CLASSIFICATION: Exploratory-New Field

Andy Hauge, Agent
MAXUS EXPLORATION CO.
2530 J Street, Suite 302
Sacramento, CA 95816

Woodland, California
June 25, 1987

Your _____ proposal to drill well "Red House Fee" 65-24,
A.P.I. No. 077-20496, Section 24, T. 3N, R. 5E, M.D. B. & M.,
--- field, -- area, -- pool,
San Joaquin County, dated 6/25/87, received 6/25/87 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8-5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 5½" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8-5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 2 M requirements is installed on the 5½" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The division is furnished copies of any draw down or back pressure tests performed. In addition the division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8-5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.

NOTE: 1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 500'.
2. This well has been granted confidential status for two years from the cessation of drilling operations.

Blanket Bond
RLH:et
CONFIDENTIAL STATUS
cc: J. M. Pachulski, WY

8/1/87
MFC

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this report and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (11/82/DWRR/5M)

7-7-87

RLH/Ed Stanley

TD 5862 No Shows

BFW 500' Shoe at 605'

① PWC 655'-450' or above DOG Tag Combo Shoe/BFW

② PWC 30'-5'

Maxus Exploration Co
P.O. Box 2530
Mills, Wyoming 82644
307 266-1882

MAXUS

DIVISION OF OIL AND GAS
RECEIVED
JUN 2 1987
WOODLAND, CALIFORNIA

June 25, 1987

State of California
Division of Oil & Gas
117 W. Main Street, Suite 11
Woodland, California 95695
Attn: John Sullivan

Re: Red House Fee 65-24

Dear John:

Maxus Exploration Company hereby requests confidential status on the subject wll.

Thank you.

Sincerely,

James M. Pachulski
Sr. Environmenal & Regulation Engineer

JMP:jp

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
117 WEST MAIN STREET, SUITE No. 11
WOODLAND, CALIFORNIA 95695
(916) 662-4683

June 16, 1987

Mr. James M. Pachulski
MAXUS EXPLORATION COMPANY
P. O. Box 2530
Mills, Wyoming 82644

RE: MAXUS EXPLORATION COMPANY &
DIAMOND SHAMROCK EXPL. CO.

Dear Mr. Pachulski:

This office received a Notice of Intention To Drill (Form CG 105) from MAXUS EXPLORATION CO. for well "Red House Fee" 65-24 in San Joaquin County, CA. Todate bond coverage has not been provided by MAXUS EXPLORATION COMPANY. This letter is to advise you that a permit cannot be issued until bond coverage is provided. This coverage can be provided by a rider to the existing Blanket Bond (National Fire Insurance Company of Hartford) or an individual Bond (in the name of MAXUS EXPLORATION COMPANY).

Yours truly,

John C. Sullivan
Deputy Supervisor

JCS/sd

cc: Andy Hauge
Diamond Shamrock Expl. Co., Denver

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
117 WEST MAIN STREET, SUITE No. 11
WOODLAND, CALIFORNIA 95695
(916) 662-4683

June 3, 1987

Mr. James M. Pachulski
MAXUS ENERGY CORP.
P. O. Box 2530
Mills, Wy 82644

Re: Maxus Exploration Company
& Diamond Shamrock Exploration Co.

Dear Mr. Pachulski:

It has been brought to my attention that the properties operated by Diamond Shamrock Exploration Company will be operated by Maxus Exploration Company. I would like to advise you that no information pertaining to the transfer or name change has been received by the Division. In addition, bond coverage has not been provided by the proposed new operator.

No operations can be conducted by Maxus Exploration Company until bond coverage is provided.

Yours truly,

John C. Sullivan
Deputy Supervisor

JCS:cm

cc: Andy Hauge
Co. - Denver

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
117 WEST MAIN STREET, SUITE No. 11
WOODLAND, CALIFORNIA 95695
(916) 662-4683

June 2, 1987

Mr. Andy Hauge
MAXUS EXPLORATION COMPANY
P. O. Box 2530
Mills, Wyoming 82644

RE: MAXUS EXPLORATION COMPANY
Well "Red House Fee" 65-24
Sec. 24, T. 3N., R. 5E., M.D. B.&M.
San Joaquin County

Dear Mr. Hauge:

This office is in receipt of a Notice of Intention To Drill (Form OG 105) for the above well. Todate, bond coverage has not been provided and approval cannot be granted until this coverage is provided. In addition, we need a copy of the environmental document prepared by San Joaquin County.

Copies of the Designation of Agent (Form OG 134A) and Questionnaire (Form OG 7) should be provided as soon as possible.

In addition, we also have a well proposed by DIAMOND SHAMROCK EXPLORATION COMPANY permitted on the same lease. Please explain this situation.

Yours truly,

John C. Sullivan
Deputy Supervisor

JCS/sd

Enclosures

SAN JOAQUIN COUNTY
DEPARTMENT OF PLANNING AND BUILDING INSPECTION

1810 E. HAZELTON AVE., STOCKTON, CA 95205
PLANNING PHONE 209/944-3722
BUILDING PHONE: 209/944-3701

CHET DAVISSON
Director

JERRY HERZICK
Deputy Director

TOM WALKER
Deputy Director

DIVISION OF OIL AND GAS
RECEIVED
JUN 1987
WOODLAND, CALIFORNIA

June 5, 1987

State of California
State Division of Oil and Gas
1416 Ninth Street, Room 1316
Sacramento, CA 95814

Gentlemen:

RE: DP-87-59 of Red House Ranching Company
(c/o Maxus Energy Corporation)

On March 25, 1987, the San Joaquin County approved the application noted.

A revised location has been submitted and was approved on June 1, 1987.

The new site is on the same surface and mineral owner is the same.

The approved drill site is located 1800' west and 2300' north of the southeast corner of Section 24, T.3N., R.5E., southwest of Lodi.

If you have any questions, please do not hesitate to call this office.

Sincerely,

DOM DE LA TORRE
Associate Planner

DD:gjm

cc: Local Health Department
Public Works Department
Building Division
Maxus Energy Corporation

Exploratory N.F.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

Requested Conf Status

DIVISION OF OIL AND GAS
RECEIVED
JUN 25 1987
BAKERSFIELD, CALIFORNIA

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS____	NEG. DEC. ☐ S.C.H. NO.____	E.I.R. ☐ S.C.H. NO.____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☐
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
640	RT 6-25-87	✓	BB	✓	✓

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well Red House Fee 65-24, well type Gas, API No. 077-20496 (Assigned by Division)

Sec. 24, T. 3N, R. 5E, ____ B. & M., ____ Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 182 acres, is as follows: (Attach map or plat to scale)

See attached Lease and Assessors Map

County Permit OK

Do mineral and surface leases coincide? Yes XX No____. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 2,300 feet North (Direction) along section / ~~property line and~~ (Cross out one) 1,800 feet West (Direction)

at right angles to said line from the Southeast corner of section / ~~property~~ (Cross out one) 24 or T3N, R5E

Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) at total depth: ____ feet ____ (Direction) and ____ feet ____ (Direction)

Elevation of ground above sea level 9.2 feet.

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table, or Kelly Bushing) that is 14 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
8 5/8"	24#	K-55	+11.5 SL	-600	-600	248 Cubic Ft.
5½"	15.5#	K-55	+11.5 SL	-6,000	-6,000	660 Cubic Ft.

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Starkey, 5,860', 2000 psi (Name, depth, and expected pressure) Estimated true vertical depth 6,000'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
Maxus Exploration Company	Corporation	
Address	**City**	**Zip Code**
P.O. Box 2530	Mills, Wyoming	82644
Telephone Number / **Name of Person Filing Notice**	**Signature**	**Date**
307-266-1882 / Andy Hauge	Andy Hauge	May 29, 1987

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

OG105 (10/84/DWRH/5M)

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: San Joaquin County

Lead Agency Contact Person: Dom De/La Torre

Address: San Joaquin County Planning Department

Stockton, California

Phone: (209) 944-3722

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks:

CRITICAL WELL

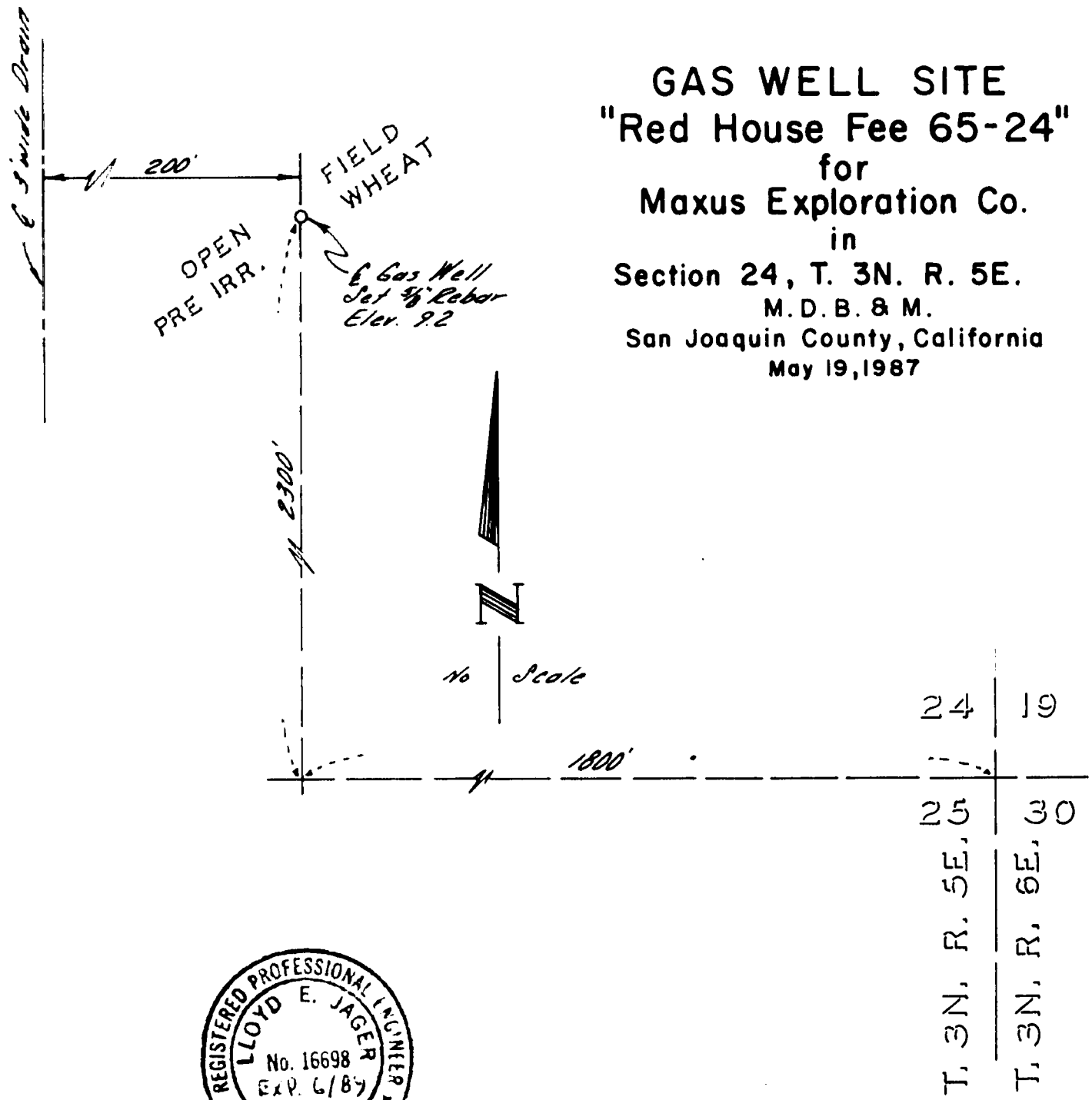
As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

YOLO ENGINEERS & SURVEYORS, INC.
WOODLAND PH. 662-4346 • DAVIS PH. 753-2515 • WEST SACTO PH. 371-7076
Post Office Box 1364 1216 Forma Avenue
WOODLAND, CALIFORNIA
95695

GAS WELL SITE
"Red House Fee 65-24"
for
Maxus Exploration Co.
in
Section 24, T. 3N. R. 5E.
M.D.B. & M.
San Joaquin County, California
May 19, 1987



REGISTERED PROFESSIONAL ENGINEER
LLOYD E. JAGER
No. 16698
EXP. 6/89
CIVIL
State of California

LE Jager

Schlumberger

DUAL INDUCTION-SFL-SONIC
WITH LINEAR CORRELATION PLOT

COMPANY	MAXUS ENERGY COMPANY
WELL	"RED HOUSE FEE" #65-24
FIELD	LODI GAS
COUNTY	SAN JOAQUIN STATE CALIFORNIA
LOCATION	2350'N AND 1800'W FROM SE CORNER
Other Services:	SHDT

RECEIVED
JAN 6 1988
DIVISION OF OIL AND GAS
WOODLAND, CALIFORNIA

API SERIAL NO. 077-20496 | SECT. 24 | TWP. 3N | RANGE 5E

Permanent Datum	GL	Elev. 9.2 F		Elev.K.B. 18.7 F
Log Measured From	KB	9.5 F	above Perm. Datum	D.F. 17.7 F
Drilling Measured From	KB			G.L. 9.2 F

Date	07-JUL-87			
Run No.	1			
Depth Driller	5762.0 F			
Depth Logger (Schl.)	5764.0 F			
Btm. Log Interval	5758.0 F			
Top Log Interval	608.0 F			
Casing-Driller	9 5/8" @ 608.0 F	@	@	@
Casing-Logger	608.0 F			
Bit Size	7 7/8"			
Type Fluid in Hole	OMNIPOL/DRISPAC			
Dens. / Visc.	9.80 LB/G	35.0 S		
pH / Fld. Loss	9.5	5.0 C3		
Source of Sample	MUDPIT			
Rm @ Meas. Temp.	4.780 OHMM	@ 76.0 DEGF	@	
Rmf @ Meas. Temp.	4.680 OHMM	@ 68.0 DEGF	@	
Rmc @ Meas. Temp.	6.410 OHMM	@ 68.0 DEGF	@	
Source: Rmf / Rmc	MEASURED	MEASURED		
Rm @ BHT	2.774 OHMM	@ 136. DEGF	@	
Circulation Ended	04:00 7-7			
Logger on Bottom	08:16 7-7			
Max. Rec. Temp.	136. DEGF			
Equip. Location	8126	SACRAMENTO		
Recorded By	SCOTT PILCH			
Witnessed By	TOM STOTLER			

FIELD LOCATION WELL COMPANY
LODI GAS
2350'N AND 1800'W
"RED HOUSE FEE" #65-24
MAXUS ENERGY COMPANY

FOLD HERE

The well name, location and borehole reference data were furnished by the customer.

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

Run No.	1			
Service Order No.	606440			
Drilling Fluid Level				
Salinity	550.0 PPM			
Rmf @ BHT	2.456 OHMM	@ 136. DEGF	@	
Rmc @ BHT	3.362 OHMM	@ 136. DEGF	@	
Logging Speed	3600.0 F/HR			
Equipment Date				
Tool Number 1	DIS-EC 1342			
Tool Number 2	DIC-DA 1149			
Tool Number 3	MCD-DA 306			
Tool Number 4	SLS-RC 252			
Tool Number 5	SLC-FA 1321			
Tool Number 6	EM-BD 242			
Tool Number 7	SLM-GA 428			
Tool Number 8	NLM-BC 468			
Tool Number 9	SGC-JC 3207			
Tool Number 10				
Tool Number 11				
Tool Number 12				

REMARKS:

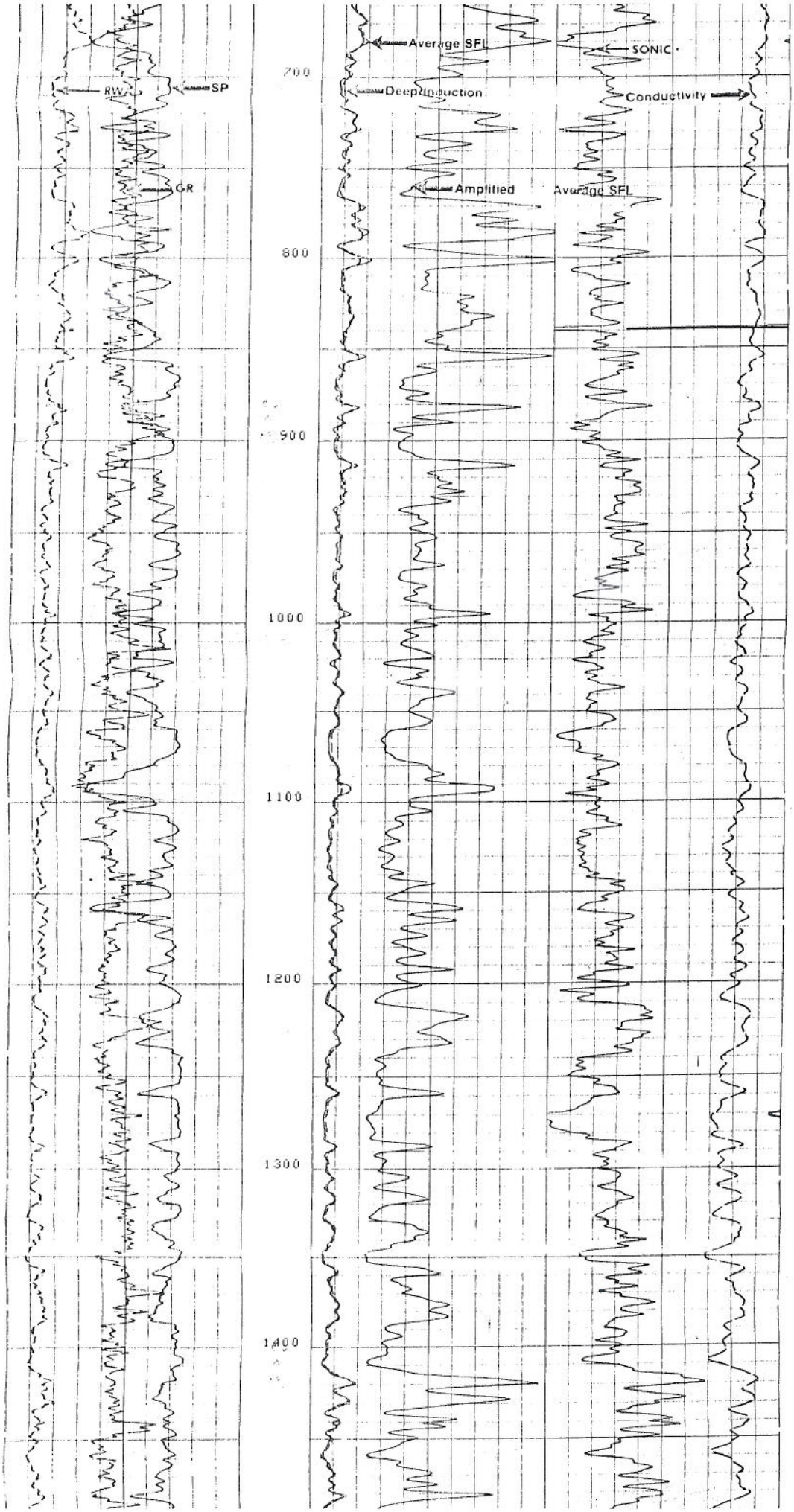
THANK YOU FOR USING SCHLUMBERGER.
RIG: HEXADYNE #6
CREW: TIBBETTS/DELACRUZ

CEMENT VOLUME = 1571.35 F3
HOLE VOLUME = 1571.35 F3
FROM 5762.0 TO 605.0 FEET

RWA (OHMM) 0.0 – 3.0000	ILD (OHMM) 0.0 – 30.000	CILD(MMHO) 0.0 – 0.0	
GR (GAPI) 0.0 – 150.00	SFLA(OHMM) 0.0 – 6.0000	SFLA(OHMM) 2000.0 – 30.000	DT (US/F) 175.00 – 75.000
SP (MV) -100.0 – 0.0	SFLA(OHMM) 0.0 – 30.000		

CP 30.22 FILE 5 07-JUL-87 09:29

2"/100'
600
USG


RWV
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SONIC
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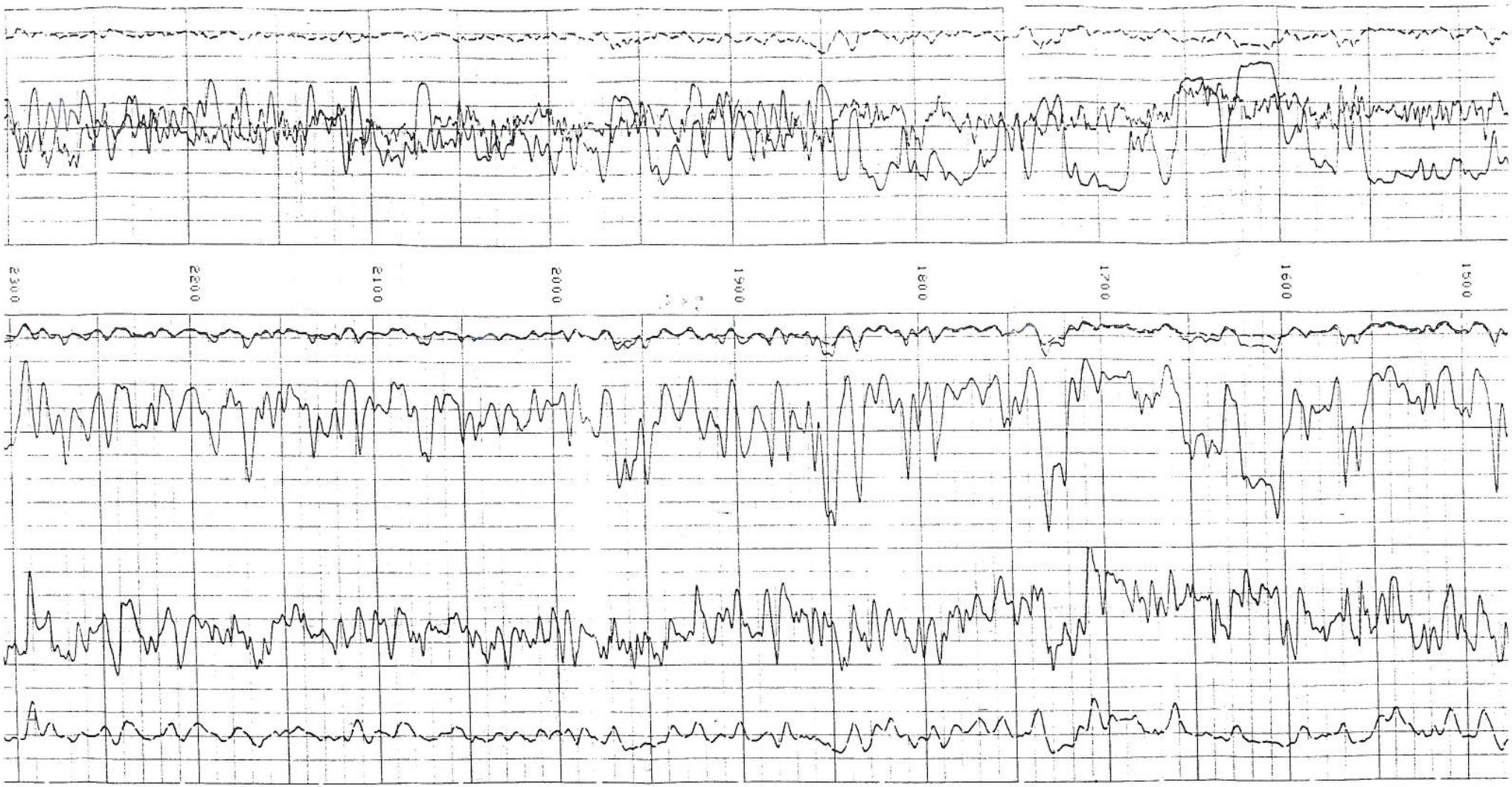
Conductivity
Amplified
Average SFL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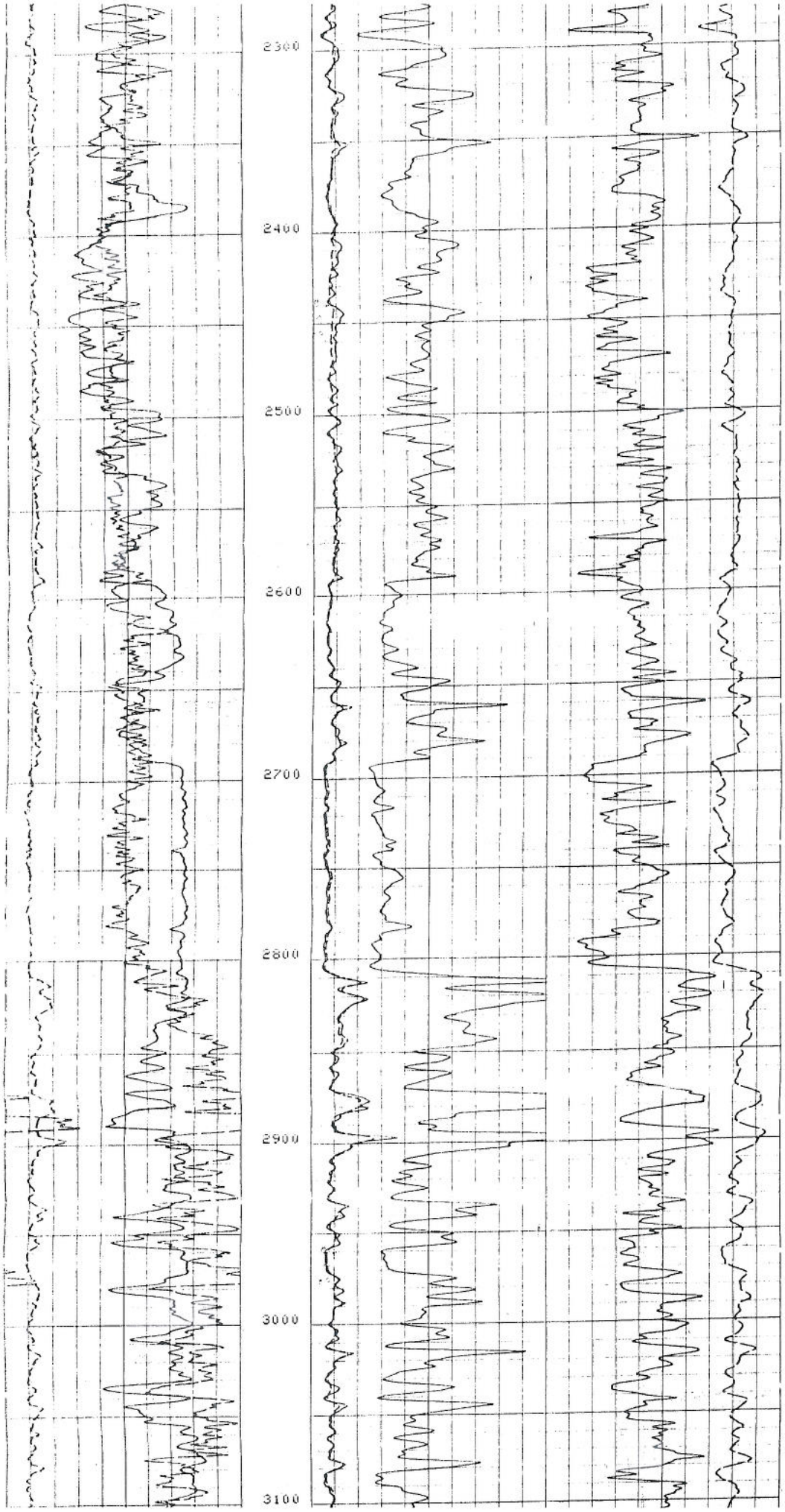
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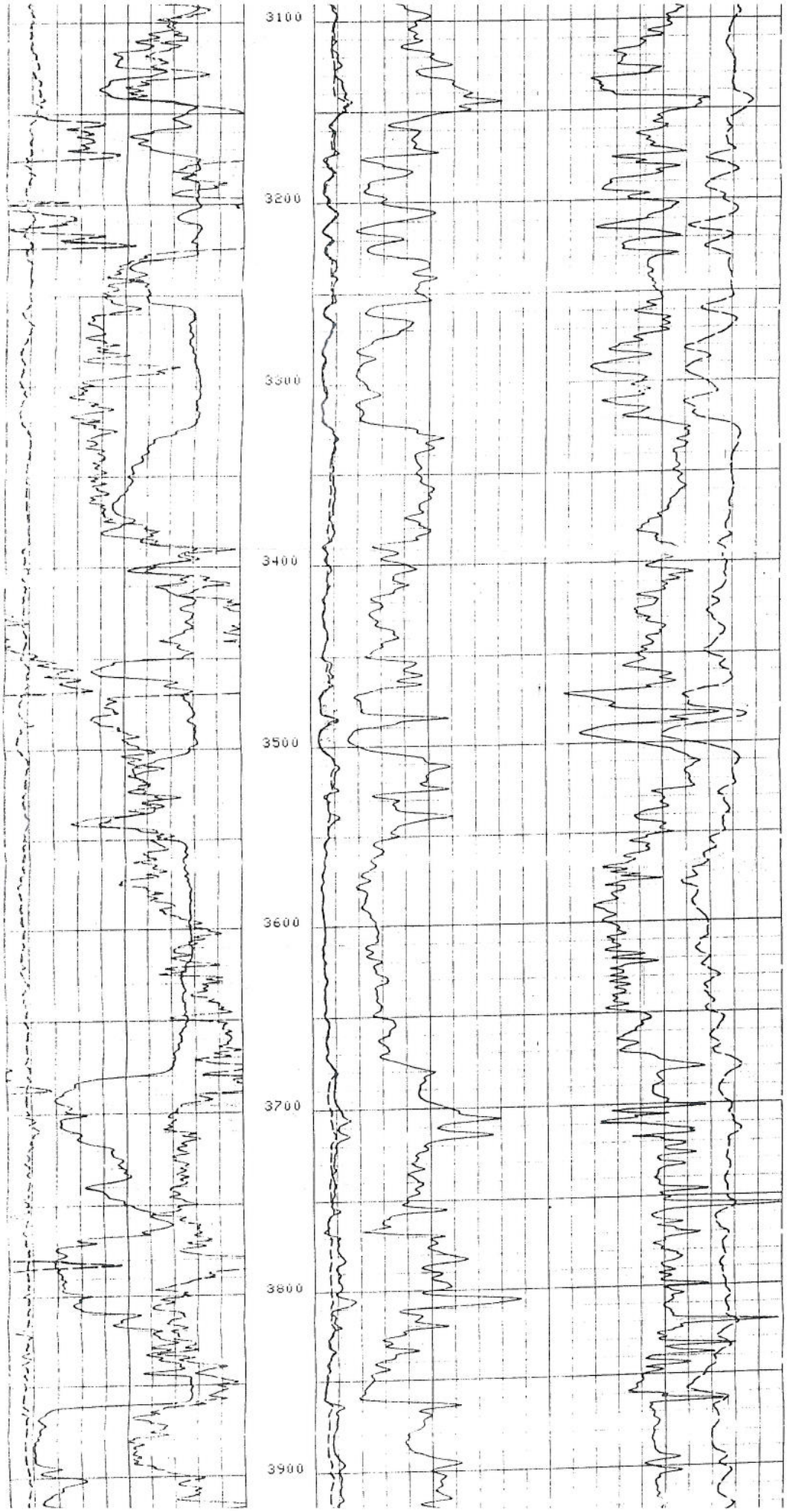
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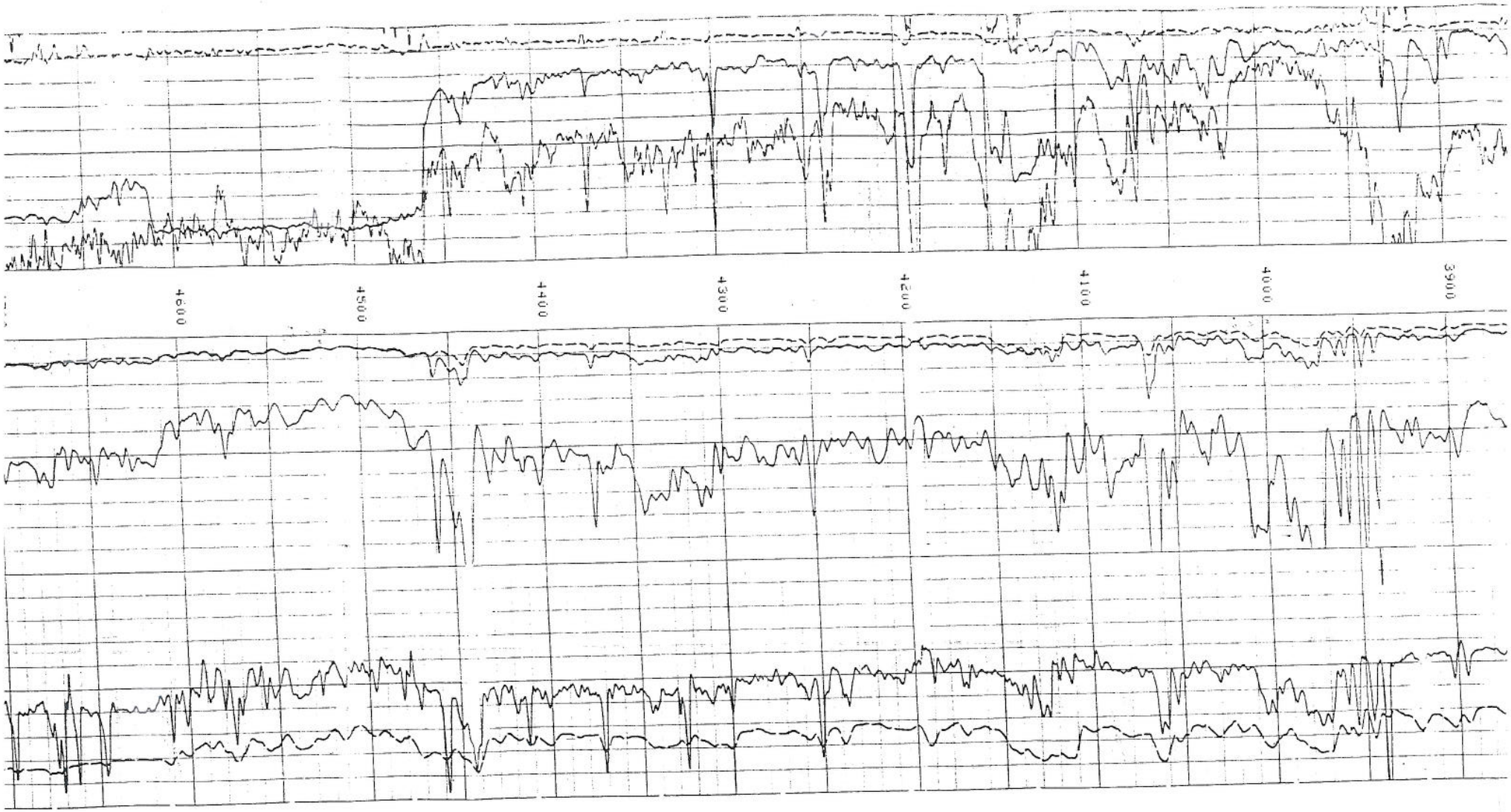
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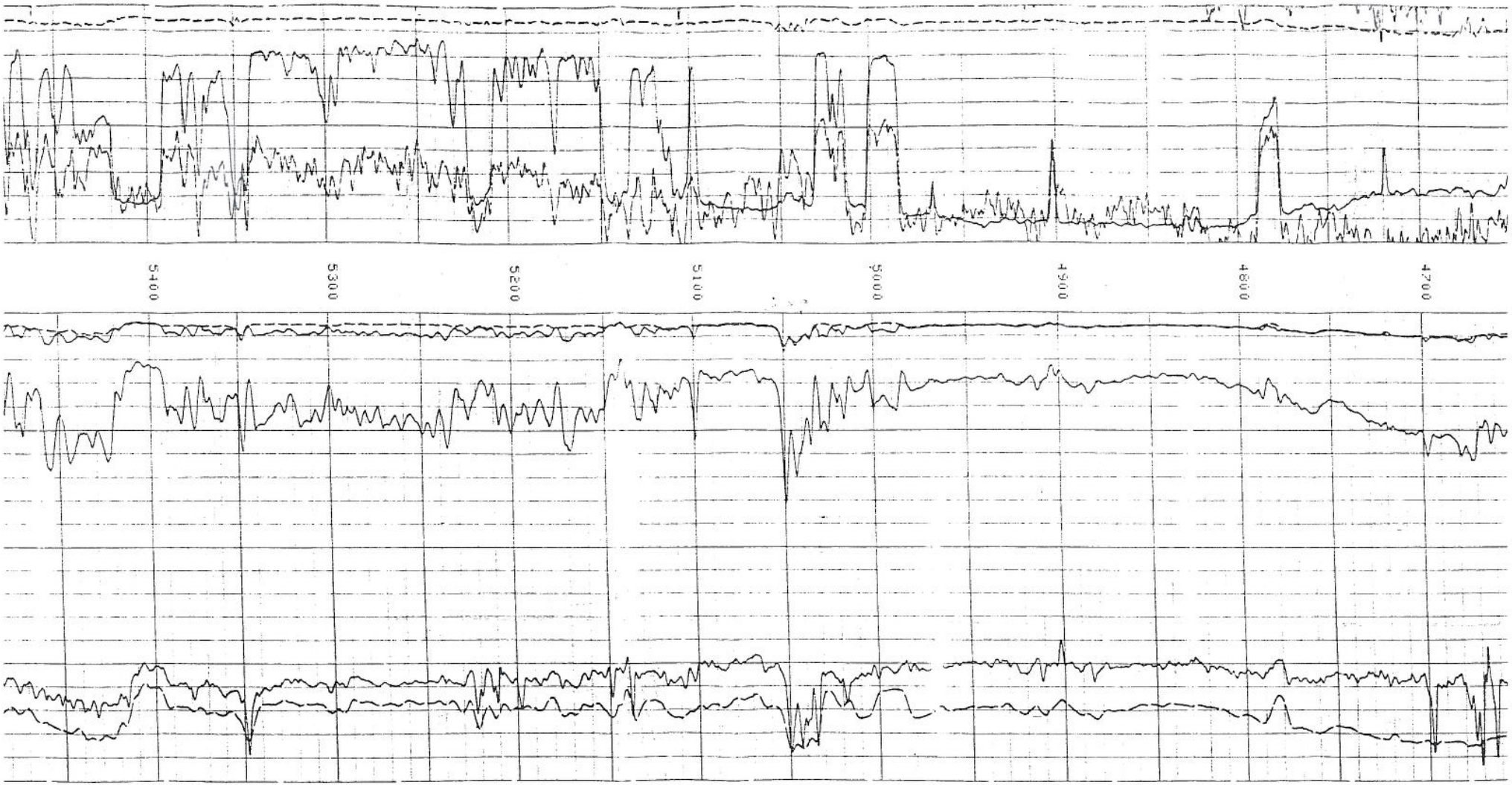
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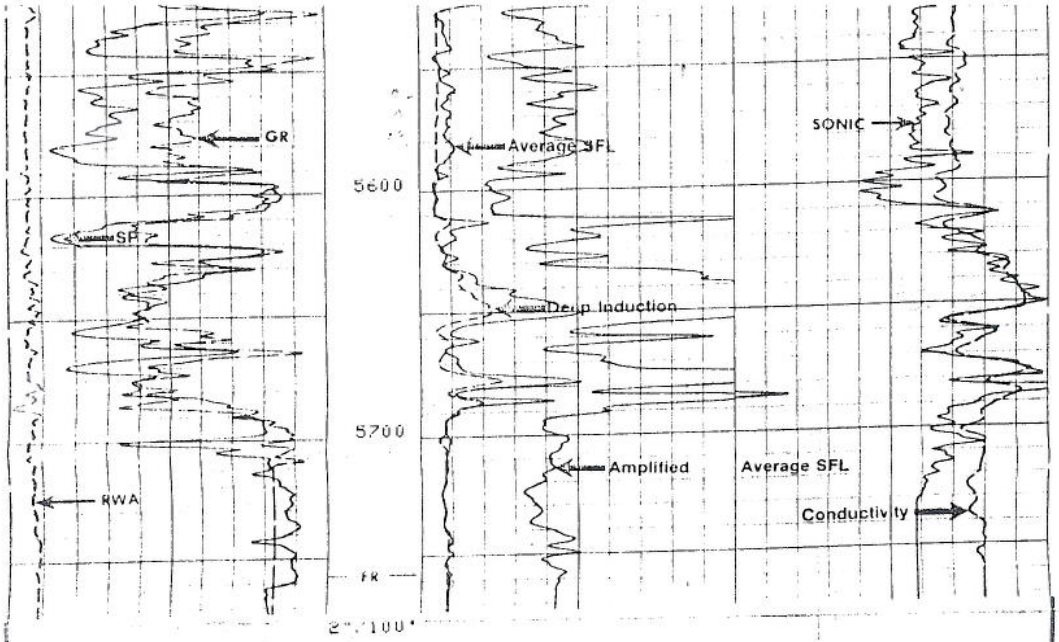
4800
4700



CP 30.22 FILE 5 07-JUL-87 08:15

RWA (OHMM) 0.0 3.0000		ILD (OHMM) 0.0 30.000	
GR (GAPI) 0.0 150.00		SFLA(OHMM) 0.0 6.0000	CILD(MMHO) 2000.0 0.0
SP (MV) -100.0 0.0		SFLA(OHMM) 0.0 30.000	DT (US/F) 175.00 75.000

SENSOR MEASURE POINT TO TOOL ZERO

SRAT	41.4	FEET	AMPL	43.8	FEET
TT1	42.8	FEET	CBL	43.8	FEET
TT3	40.1	FEET	TT2	43.8	FEET
T0	43.8	FEET	TT4	39.1	FEET
SLTT	43.8	FEET	TT	43.8	FEET
GR	64.1	FEET	SCBL	43.8	FEET
ILD	9.4	FEET	CALI	31.8	FEET
SFL	6.4	FEET	ILM	5.8	FEET
SPAR	2.5	FEET	SP	2.5	FEET
NOIS	2.5	FEET	TENS	2.5	FEET

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
BS	7.87500	IN	BHS	OPEN	
SPFS	R-H		FPHI	SPHI	
DTM	56.0000	US/F	CDTS	100.000	
DDEL	200	US	DTF	189.000	US/F
DWCO	512		DSIN	5	US
SBR	1.00000	OHMM	DSEC	4.90000	MMHO
WMUD	9.80000	LB/G	MSEC	7.70000	MMHO

REMARKS:

THANK YOU FOR USING SCHLUMBERGER.
RIG: HEXADYNE #6
CREW: TIBBETTS/DELACRUZ

Rio Blanco #1
API No. 07720172

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland California

February 20, 1973

Mr. Charles W. Hatten, Agent
GREAT BASINS PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, CA 90067

DEAR SIR:

Your report of abandonment of Well No. "Rio Blanco" 1 (077-20172), Sec. 27, T. 3N, R. 5E, M.D. B. & M., -- field, San Joaquin County, dated Nov. 13,1972, received Feb. 15, 1973, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

Blanket Bond
RJ:rmc

JOHN F. MATTHEWS, JR.
State Oil and Gas Supervisor

By R. M. Barger
Deputy Supervisor

Sec. 27, T. 3N, R. 5E
San Joquin Company.

RECORDS RECEIVED		STATUS	DATE
Date Received		Producing - Oil	
Well Summary (Form 100)	11/29/72	Idle - Oil	
History (Form 103)	11/29/72.	Abandoned - Oil	
Core Record (Form 101)		Drilling - Idle	
Elec. Log - Lge. 2 Small		Abandoned - Dry Hole	Oct. 18, 1972
Direct. Survey		Producing - Gas	
Sidewall Samples		Idle - Gas	
Other Mud log - 1		Abandoned - Gas	
		Gas - Open to Oil Zone	
Notice of Records Due Form 170		Water Flood Source	
		Water Disposal	
Date Final Records Received		Water Flood	
		Steam Flood	
		Fire Flood	
		Air Injection	
		Gas Injection	
		CO_2 Injection	
		LPG Injection	
		Observation	

RECOMPLETED

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports ✓
10. Casing Record ✓
11. Plugs
12. Surface Inspection
13. Production

CLERICAL CHECK LIST

1. Location change ____ (F-165)
2. Elevation change ____ (F-165)
3. Form 121 ✓
4. Form 159 (Final Letter) Yes
5. Form 150b (Release of Bond) Yes

(077-20172)

RECORDS NOT APPROVED
Reason:

RECORDS APPROVED

RELEASE BOND
Date Eligible
(Use date last needed records were received.)

MAP & MAP BOOK

FORM 19

WELL SUMMARY REPORT

NOV 29 1972

SUBMIT IN DUPLICATE

WOODLAND, CALIFORNIA

Operator GREAT BASINS PETROLEUM CO. Well No. Rio Blanco - 1

Sec. 27, T. 3 N., R. 5 E., M. D. B. & M. - - - Field San Joaquin County.

Location 2700 feet South and 2000 feet West from projected Northeast corner projected section 27
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level - 5 feet.

All depth measurements taken from top of Kelly Bushing which is 11.0 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

In compliance with Sec. 3215, of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date November 13, 1972

Signed Charles W. Hatten
Charles W. Hatten

R. O. Stein, Jr. (Engineer ~~or Geologist~~) (Superintendent)

Title President (President, Secretary or Agent)

Commenced drilling October 14, 1972

Completed drilling

Total depth 5450' Plugged depth 557 - 360'

Junk NONE " " 40 - 15'

GEOLOGICAL MARKERS	DEPTH

Geologic age at total depth: Meganos - Martines

Commenced producing Non Productive (Date) Flowing/gas lift/pumping (Cross out unnecessary words)

Name of producing zone

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cementing if through perforations
8 5/8"	523	Surface	24#	New	Smlss	K-55	12 1/4	281 equiv.	

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was the well directionally drilled? Electrical Log Depths 4995' - 523' (Attach Copy of Log)

△ OSP

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR GREAT BASINS PETROLEUM CO. FIELD ---

Well No. Rio Blanco - 1, Sec. 27, T. 3 N., R. 5 E., M. D. B. & M.

Date November 13, 1972 Signed Charles W. Hatten
Charles W. Hatten

1011 Gateway West, Century City
Los Angeles, Calif. 90067 (213) 879-0666 Title President
(Address) (Telephone Number) (President, Secretary or Agent)

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data.

1972

Date

10/14 Hunnicutt & Camp rig No. 1 spudded well @ 3:30 PM. Drilled 12 1/4" hole to 523' circulated; wiped hole; circulated clean; pulled out. Ran 13 Jts (525.37' O.A.) 8 5/8" 24#, K-55, new, smlss, 8 R. T. & C., Rg. 3, Armco casing equipped with Larkin guide shoe and one centralizer latched over first casing collar.

10/15 Halliburton cementers pumped 130 sx class "G" cement premixed w/ 4% gel & 2% $CaCl_2$ followed by 100 sx class "G" cement premixed w/ 2% $CaCl_2$ total slurry included 50% in excess of theoretical requirements @ 500'. C.I.P. 12:30 AM 10/15; had no cement returns to surface. Ran 1" tubing to 50' in annulus & pumped 50 sx class "G" cement with 2% $CaCl_2$ in mixing water; had four c.f. cement returns to surface. C.I.P. 1:30 AM 10/15. Stood cemented two hours. Landed casing; cut off conductor and casing. Installed National S.O.W. Series 900 casing head. Tested welds @ 2500 psig. Installed B.O.E. double hydraulic Shaffer rams and "GK" Hydril bag, both series 900; tested casing and C.S.O. rams @ 1500 psig Oke. Ran in with 7 7/8" bit. Located top of plug at 511'. Tested pipe rams, Hydril and Kelly cock at 1500 psig; held Oke. Drilled out plugs, cement and shoe at 3 PM. Drilled to 1932'. Mud weight 72 - 74 pcf, viscosity 41 - 45 secs/quart, water loss 10.8 cc. Drift surveys: 523' 0°30'.

10/16 Drilled 7 7/8" hole to 3085'; made bit trip. Stratagraphic Mud Logging Co. commenced sampling drilling returns at 3000'. Drilled to 4288'. Mud wt. 74 - 76 pcf, vis. 40 - 45, W.L. 10.6 - 8.6. Surveys: 2332' 1°15', 3085' 2°30'.

10/17 Drilled 7 7/8" hole to 5000'; circulated & conditioned mud; pulled out. Ran & recorded Schlumberger IES log. Ran bit #5 to drill ahead. Mud weight 76 - 78, vis. 42, W.L. 7.4. Surveys: 4°00' at 4828'.

10/18 Drilled 7 7/8" hole to 5450'. Circulated clean; pulled bit; layed down drill collars and portion of drill pipe. Ran in open ended to 557'. Halliburton equalized 100 sx class "G" cement premixed w/ 3% $CaCl_2$; C.I.P. 1:00 PM 10/18. Located top of firm cement at 360' at 5:00 PM; location and hardness of plug witnessed and approved by D.O.G. engineer. Layed down drill pipe. Cut off casing at cellar floor level (four feet below ground). Placed 25 feet cement plug in casing on top of mud sack bridge (29 feet below ground level). Welded steel plate over casing stub to complete abandonment. Rig released at 11:00 PM.

DIVISION OF OIL AND GAS

Report on Operations

No. T 672-220

Mr. Charles W. Hatten, Agent
GREAT BASINS PETROLEUM COMPANY
1011 Gateway West - Century City
Los Angeles, Cal. 90067

Woodland, Calif.
October 30, 1972

DEAR SIR:

Operations at well No. "Rio Blanco" 1(077-20172), Sec. 27, T. 3N., R. 5E., M.D. B & M. Field, in San Joaquin County, were witnessed on October 18, 1972. Mr. R. Johnson, representative of the supervisor was present from 1645 to 1715. There were also present L. Camp, Drilling Foreman.

Present condition of well: 8-5/8" csg. 523'. TD 5450', plugged with cement 575'-360'.

The operations were performed for the purpose of witnessing the location and hardness of a cement plug placed in the process of abandonment.

Mr. reported:

THE LOCATION AND HARDNESS OF THE CEMENT PLUG AT 360' ARE APPROVED.

RJ;jp
cc: Company

Issuance of this report was delayed pending receipt of notice to abandon.

JOHN F. MATTHEWS, JR.
State Oil and Gas Supervisor

By R. M. Basgus Deputy

59471-708 1-72 20M ⓢ OSP

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 672-295

Mr. Charles W. Hatten, Agent
GREAT BASINS PETROLEUM COMPANY
1011 Gateway West - Century City
Los Angeles, Cal. 90067

Woodland, Calif.
October 30, 1972

DEAR SIR:

(077-20172)

Your proposal to abandon Well No. "Rio Blanco" 1, Section 27, T. 3N., R. 5E., M.D. B. & M., - - - Field, San Joaquin County, dated 10-23-72, received 10-27-72, has been examined in conjunction with records filed in this office.

THE PROPOSAL COVERING WORK ALREADY COMPLETED UNDER PRIOR AGREEMENT IS APPROVED.

Blanket Bond
RMB:jp
cc: Company

JOHN F. MATTHEWS, JR., State Oil and Gas Supervisor

By R. M. Barger, Deputy

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin; one copy only

OCT 27 1972

WOODLAND, CALIFORNIA

Los Angeles Calif. October 23, 1972

DIVISION OF OIL AND GAS

In compliance with Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon

Well No. Rio Blanco - 1, Sec. 27, T. 3 N., R. 5 E., M. D. B. & M., - - - Field, San Joaquin County,

commencing work on October 18, 1972.

THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 5450'

2. Complete casing record, including plugs:
8 5/8" 24# K-55 Smlss casing cemented at 523' with 281 equivalent sx cement

3. Last Produced Non - productive
(Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:
No showings
No tests

5. Stratigraphic markers and depths:

6. Formation at bottom: Meganes - Martinez

7. Base of fresh water sands: above 523'

THE PROPOSED WORK IS
in accordance with telephone conversation Stein - Johnson:

1) Place 100 feet cement plug 573' - 473'.

2) Place 25 feet cement plug 40' - 15'.

3) Cut off casing at cellar floor level; weld steel plate over casing stub.

MAP	MAP			FORMS	
				110	121
	10/27/72 E	✓	✓	✓	✓

1011 Gateway West, Century City
Los Angeles, Ca. 90067
(Address)

(213) 879 - 0666
(Telephone No.)

GREAT BASINS PETROLEUM CO.
(Name of Operator)

By Charles H. Hallin President

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 672-213

Floyd Tincher, Agent
GREAT BASINS PETROLEUM COMPANY
2694 Cottage Way #7
Sacramento, CA 95825

Woodland, Calif.
September 12, 1972

DEAR SIR:

Your proposal to drill Well No. "Rio Blanco" 1 (077-20172)
Section 27, T. 3N., R. 5E., M.D.B. & M., Field, San Joaquin County,
dated 9-5-72, received 9-8-72, has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8-5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. Mud fluid of proper weight and consistency is used and the well is kept under control at all times.
3. Blowout-prevention equipment capable of shutting the well in during any operation is installed and maintained ready for use at all times.
4. Fresh waters, if present, are protected by cement behind the 4½" casing. Sufficient cement must be used to fill to at least 100' above the base of fresh waters.
5. This Division is notified:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a pressure test of the blowout-prevention equipment prior to drilling out the shoe of the 8-5/8" casing.
   c. To witness a test of the 4½" water shut-off immediately above the objective zone.

Blanket Bond
RJ:jp

cc:Co.

BOE waived 12-15-72
SC

JOHN F. MATTHEWS, JR., State Oil and Gas Supervisor

By R. M. Barger SC, Deputy

57628-708 11-71 35M ① OSP

FORM 105

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and surety bond must be filed before drilling begins

DIVISION OF OIL AND GAS
RECEIVED
SEP 8 1972
WOODLAND, CALIFORNIA

077-20172

10

Los Angeles Calif. September 5 1972

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division III, Article 4, Public Resources Code, notice is hereby given that it is our intention to commence drilling well No. Rio Blanco No. 1, Sec. 27, T. 3 N, R. 5 E, M.D. B. & M., King Island Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 678 acres, is as follows: (Attach map or plat to scale)

Do mineral and surface leases coincide? Yes Yes No If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of Well: 2700 feet South (Direction) along ~~property~~ section line and 2000 feet West (Direction) at right angles to said line from the Northeast corner of ~~property~~ section 27

T 3 N R 5 E M.D. B. & M.

Elevation of ground above sea level 0 feet U.S.G.S. datum.

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table or Kelly Bushing) which is 11 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES A.P.I.	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS
8-5/8"	24#	K-55	0	500'	500'
4-1/2"	9.5#	K-55	0	4900'	4900'

Intended zone(s) of completion: Mokelumne (Name) 4660' - 4900' (Depth, top and bottom) Estimated total depth 4900'

MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
		✓	✓		✓

Fill above 500'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address 1011 Gateway West - Century City
Los Angeles, California 90067

Telephone Number (213) 879-0666

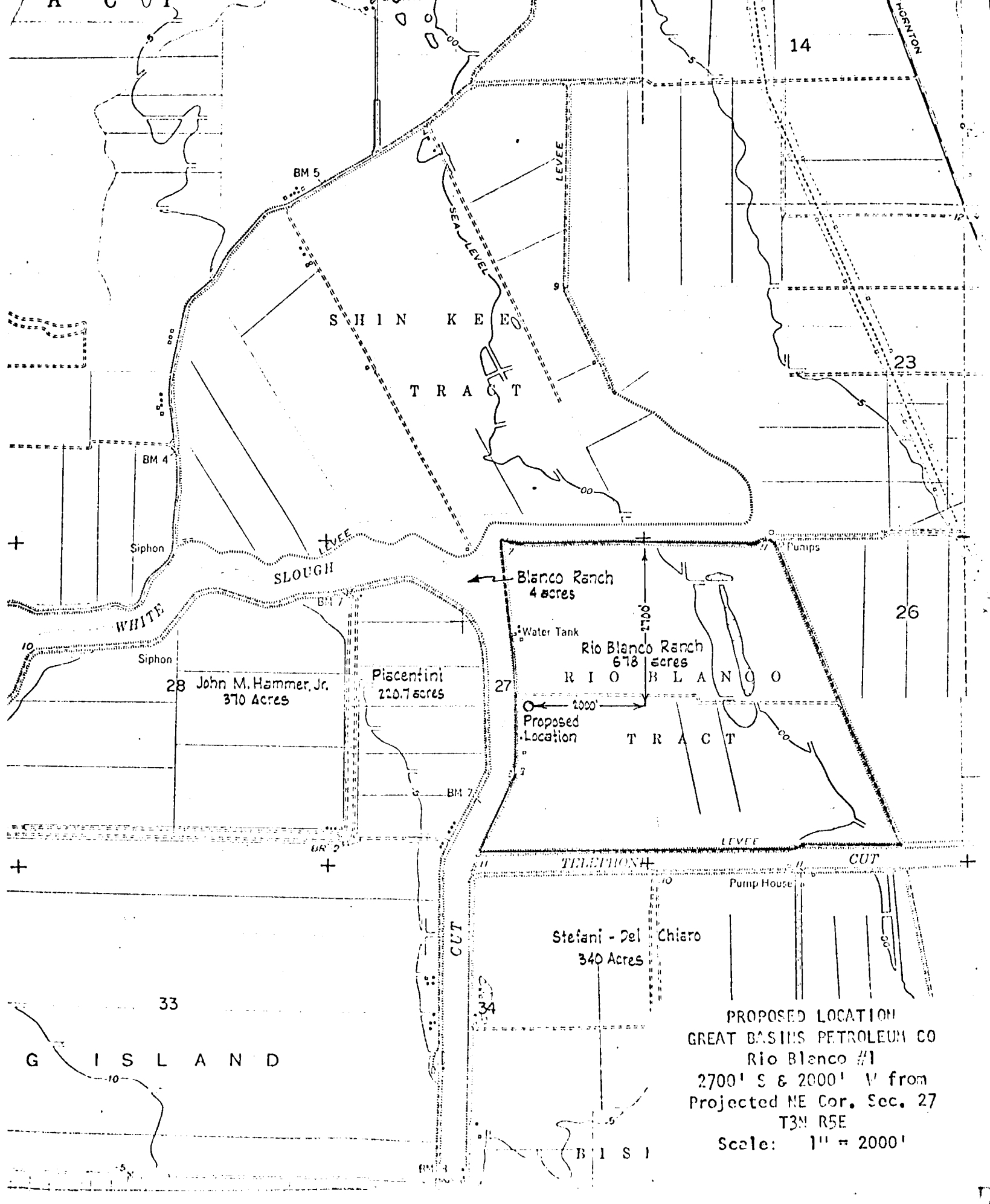
Great Basins Petroleum Co. (Name of Operator)

By C. W. Hatten, President

Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

(077-20172)

△ OSP



PROPOSED LOCATION
GREAT BASINS PETROLEUM CO
Rio Blanco #1
2700' S & 2000' W from
Projected NE Cor. Sec. 27
T3N R5E
Scale: 1" = 2000'

Buttes-Rio Blanco #15-77X

API No. 07720381

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, California

August 18, 1983

Harry Hull, Agent
ARGO PETROLEUM CORP.
P.O. Box CI
Ventura, CA 92001

Your report of abandonment of well "Buttes-Rio Blanco" 15-77X
(Name and number)

A P I No. 077-20381, Section 15, T. 3N, R. 5E, M.D., B. & M.,

East Islands Gas field, San Joaquin County,

dated 1/4/81, received 1/11/82, has been examined in conjunction with records filed in this office, and we have determined that all of the requirements of this Division have been fulfilled.

Environmental inspection made and approved 7/18/83.

Blanket Bond
rmc:

M.G. MEFFERD
State Oil and Gas Supervisor

By John C. Sullivan RLH
Deputy Supervisor

JOHN C. SULLIVAN

OG159 (10/80/8M)

DIVISION OF OIL AND GAS
CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company ARGO PETROLEUM CORP. Well No. "Baffes-Rio Blanco" 15-77X
API No. 077-20381 Sec. 15, T. 3N, R. 5E, MD B.&M.
County SAN JOAQUIN Field —

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	1-11-82
History (Form OG103)	✓
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	
✓ 2 Mud	1-11-82
✓ 2 Cont. Dip.	✓
✓ 2 Long Spa Cont. Dip.	✓
✓ 2 DIPS FL 2"+5"	✓
✓ 2 Sonic 2"+5"	✓

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Water Flood	___
Abandoned - Oil	___	Steam Flood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	___	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Water Flood Source	___		

DATE
RECOMPLETED
REMARKS

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports waived ARD —
10. Casing Record
11. Plugs
12. Surface Inspection
13. Production
14. E Well on Prod. Dir. Sur.

CLERICAL CHECK LIST

1. Location change ___ (F-OGD165)
2. Elevation change ✓ (F-OGD165)
3. Form OGD121 ✓
4. Form OG159 (Final Letter) Yes
5. Form OGD150b (Release of Bond) B/B.
6. Duplicate logs to archives
7. Notice of Records due (F-OGD170)

FINAL LETTER

7-18-83
ESenter

RECORDS NOT APPROVED
Reason: Need surface inspection.
all else O.K. — 1-19-82

RECORDS APPROVED ESenter 7-20-83

RELEASE BOND
Date Eligible
(Use date last needed records were received.)
MAP AND MAP BOOK

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (10-78-GSRI-5M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

API No. 077-20381

WELL SUMMARY REPORT

WOODLAND, CALIFORNIA

Operator: ARGO PETROLEUM CORPORATION		Well: "Buttes-Rio Blanco" #15-77X			
Field: East Islands		County: San Joaquin	Sec. 15	T. 3N	R. 5E	B.&M. MD
Location (Give surface location from property or section corner, street center line and/or California coordinates): 957.19'N & 1348.19'W from SE corner of Section 15, T3N-R5E (MD)			Elevation of ground above sea level: 2.20'		

Commenced drilling (date): 10/13/81

Completed drilling (date): 10/24/81

Commenced producing (date):

☐ Flowing ☐ Pumping
☐ Gas lift

Name of producing zone(s): NONE

Total depth: (1st hole) 4931' (2nd) (3rd)

Present effective depth: P&A

Junk: none

Depth measurements taken from top of: ☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing

Which is 23' feet above ground

GEOLOGICAL MARKERS	DEPTH

Formation and age at total depth: Starkey; Cretaceous

	Clean Oil (bbl per day)	Gravity Clean Oil	Percent Water including emulsion	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production						
Production After 30 days						

CASING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New or Second Hand	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)
8-5/8"	surface	614'	24#/ft.	K-55, ST&C 8RD	new	12¼"	448 ft^3	

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was the well directionally drilled? If yes, show coordinates at total depth
☐ Yes ☒ No

Electrical log depths: 4925'-615' DIL/SFL

Other surveys: BHC/Sonic, Dipmeter, Mudlogger

In compliance with Sec. 3215, Division 3 of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name: Harry Hull	Title: District Superintendent	
Address: 940 E. Santa Clara Street	City: Ventura, CA	Zip Code: 93001
Telephone Number: (805) 653-5111	Signature: Harry Hull	Date: January 4, 1981

SUBMIT IN DUPLICATE

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

Operator: Argo Petroleum Corporation
Field: East Islands
County: San Joaquin
Well: Buttes-Rio Blanco #15-77X
Sec. 15, T 3N, R 5E, MD B. & M.
A.P.I. No. 077-20381
Name: Harry Hull (Person submitting report)
Title: Dist. Supt. (President, Secretary or Agent)
Date: January 4, 1982

Signature: Harry Hull

940 E. Santa Clara Street, Ventura, CA 93001 (Address)
(805) 653-5111 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date	
10/13/81	Finish MIRU Cal Pacific Rig #3. Spud at 2200 hrs. Drilled 12¼" hole to 75'.
10/14/81	Drilled to 140'. Rig SCR failed (2½ hrs). Drilled to 614'. Wiped hole to shoe. Conditioned mud for casing. POOH. Ran 15 jts. 8-5/8", 24#, K-55, ST&C 8RD casing (from Northern Truck Yard - Full Amalog inspection). Float shoe at 614' with 1 centralizer per joint for the first 2 joints. Rigged up B.J. Cementers. Cemented as follows: 50 cf. of water; 348 cf. class 'G' cement + 4% Gel + 3% $CaCl_2$; 100 cf. class 'G' cement + 3% $CaCl_2$. Displaced with 209 cf. Shut in. Had 15 cf. cement returns. C.I.P. at 2311 hrs.
10/15/81	Installed wellhead and tested welds to 1000 psi. Nippled up BOP's. Tested blind rams. RIH. Attempted to test annular - no good.
10/16/81	Repaired annular preventer. Tested pipe rams, annular and lines. DOG witnessed and approved. Drilled cement 566' to 614'. Drilled 7-7/8" hole to 1616'. Installed the mud logger at 614'.
10/17/81 to 10/18/81	Drilled 7-7/8" hole to 3670'.
10/19/81	Drilled to 3844'. SCR failure - drawworks down. Circulated and repaired SCR. Power to drawworks at 2030 hrs. Pipe stuck. Worked stuck pipe.
10/20/81	Worked stuck pipe. Spotted 50 Bbls PS-300 with 50 gal. pipe-LAX at 0500 hrs.; 20 Bbls outside, 30 Bbls inside. Moving oil @ 2½ Bbls per hour. Pipe free at 1000 hrs. Circulated out oil and conditioned mud. POOH. Repaired SCR. RIH. Drilled to 3990'.
10/21/81	Drilled to 4226'. POOH. Repaired leak in wellhead. RIH and drilled to 4274'. Repaired SCR.
10/22/81	Drilled to 4786'.
10/23/81	Drilled to 4931'. Wiped hole to shoe. Conditioned mud for logs. Rigged up Schlumberger and logged well as follows:

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

Operator Argo Petroleum Corporation Field East Islands County San Joaquin
Well Buttes-Rio Blanco #15-77X, Sec. 15, T 3N, R 5E, MD B. & M.
A.P.I. No. 077-20381 Name Harry Hull (Person submitting report) Title Dist. Supt. (President, Secretary or Agent)
Date January 4, 19 82

Signature Harry Hull

940 E. Santa Clara St., Ventura, CA 93001 (Address) (805) 653-5111 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date

DIL/SFL	4925'-615'
BHC/Sonic	4921'-2000'
Dipmeter	4930'-2000'

RIH. POOH laying down drill pipe.

10/24/81 Layed down drill pipe. RIH with O.E.D.P. to 678'. Rigged up B.J. Cementers. Pumped 131 cf. class 'G' + 6% Gel. Pulled to 307'. Pumped 52 cf. class 'G' + 6% Gel. Cement returns to surface. DOG declined to witness cementing.

Nippled down BOP's. Removed wellhead. Cut off casing and welded on steel plate. Rig released at 1500 hrs., 10/24/81.

Argo Petroleum Corporation
10880 Wilshire Boulevard
Los Angeles, California 90024

Telephone (213) 475-4976
Cable - Argpetro
Telex - 67-4080

DIVISION OF OIL AND GAS
RECEIVED
NOV 1981
WOODLAND, CALIFORNIA

Reply to:
940 East Santa Clara
Ventura, Calif. 93001

November 3, 1981
Mr. John Sullivan
Division of Oil & Gas
117 West Main Street
Suite #11
Woodland, California 95695

RE CONFIDENTIAL STATUS

Dear Mr. Sullivan:

Confidential status is hereby requested for all records of the Argo Petroleum Coorporation following wells:

Buttes Rio Blanco #15-77X Sec. 15, T3N-R5E MDB&M

Buttes-Fox #15-37X Sec. 15, T3N-R5E MDB&M

Thank you,

Sincerely,

Argo Petroleum Corporation

Harry E. Hull

Harry E. Hull
District Superintendent

HEH/sw

cc: D. Vandervort
T. Young

REPORT ON PROPOSED OPERATIONS

--
(field code)
--
(area code)
--
(new pool code)

(old pool code)

Harry Hull, Agent
ARGO PETROLEUM CORP.
P.O. Box CI
Ventura, CA 92001

Woodland, California
November 5, 1981

Your _____ proposal to abandon well "Buttes-Rio Blanco" 15-77X, A.P.I. No. 077-20381, Section 15, T. 3N, R. 5E, M.D. B. & M., --- field, --- area, --- pool, San Joaquin County, dated 10-28-81, received 11-1-81 has been examined in conjunction with records filed in this office.

THE PROPOSAL, COVERING WORK ALREADY COMPLETED IN ACCORDANCE WITH PRIOR AGREEMENT, IS APPROVED.

THIS DIVISION SHALL BE NOTIFIED:

a. To inspect and approve the clean-up of the wellsite before approval of abandonment will be issued.

Blanket Bond
KPH:kw

cc: Co., Ventura

CONFIDENTIAL STATUS

7-13-85
Escriter

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this report and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

RECEIVED NOV 1981 WOODLAND, CALIFORNIA

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin.

FOR DIVISION USE ONLY			
CARDS	BOND	FORMS 114	FORMS 121
✓	✓		✓

DIVISION OF OIL AND GAS

In compliance with Section 3229, Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon Well No. "Buttes-Rio Blanco" 15-77X, API No. 077-20381, Sec. 15, T. 3N, R. 5E, M.D. B. & M., ~~East Islands~~ Field, San Joaquin County.

commencing work on 10/25, 19 81.

The present condition of the well is:

1. **Total depth:** 4931'
2. **Complete casing record, including plugs and perforations:**

   8 5/8" cem 614'

3. Last produced Never (Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)

   or

4. Last injected (Date) (Water, B/D) (Gas, Mcf/D) (Surface pressure)

Additional data for dry hole (show depths)

5. Oil or gas shows None
6. Stratigraphic markers: None
7. Formation and age at total depth: Starkey Cretaceous
8. Base of fresh water sands: --- 300' DOG est.

The proposed work is as follows: O.E.

1. RIH w/4 1/2" drillpipe to 664' & cement to surface.

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address 940 E. Santa Clara (Street)
Ventura, California 93001
(City) (State) (Zip)
Telephone Number (805) 648-2514

Argo Petroleum Corporation (Name of Operator)
By Harry E. Hull (Name) 10-28-81 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 681-363

DIVISION OF OIL AND GAS

Report on Operations

Harry Hull, Agent
ARCO PETROLEUM CORP.
P.O. Box 91
Ventura, CA 93001

Woodland Calif.
October 21, 1981

Your operations at well "Buttes-Rio Blanco" 15-77X, API No. 077-20381, Sec. 15, T. 3N, R. 5E, M.D., B.& M. Field, in San Joaquin County, were witnessed on 10-15 and 10-16-81. R. Hauser, representative of the supervisor, was present from 2230 to 0130. There were also present B. Spears, Drilling Foreman and J. Huber, Co. Representative.

Present condition of well: 8 5/8" cem. 614', TD 614' (standing cemented).

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION

The blowout prevention equipment and installation are approved.

KPH:kw

NOTE: Deficiencies noted and to be corrected:
1. No pit level indicator.

cc: Co., Ventura

CONFIDENTIAL STATUS

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

10-23-81 Phoncon
Jim Hill / KPH

TD 4931 No shows.
Bfw 300 bbls est. 8 5/8" @ 614'
TO Aloha 664 – 564 tag
350 – 250 place
25' @ surface
5' csg removal
clean up.
Ab. Notice
Ken

10-23-81 Phoncon
Steve Kerr (Curran?) / KPH
Plug 664' – 0'
in two stages.
Ken

BLOWOUT PREVENTION EQUIPMENT MEMO

Operator Argo Pet. Corp. Well Battes-Rio Blanco 15-97x Field _____ County San Juan

VISITS:	Date	Engineer	Time		Operator's Rep.	Title
1st	10-15 & 16-81	R. Hauser	2230	to 0130	B. Spears	D.F.
2nd				to	J. Huber	Co. Rep.

Casing record of well: 8 5/8" cem. 619'. T.D. 619'. (Standing Cemented)

OPERATION: (Testing) (~~Inspecting~~) the blowout prevention equipment and installation.
DECISION: The blowout prevention equipment and installation are approved.

REQUIRED BOPE CLASS: III B2A

Proposed Well Opns: Borehole MPSP: _____ psi
Hole size: 12 1/4" fr. SUR ' to Shoe ', 7 7/8" to T.D. ' & _____" to _____'

CASING RECORD (BOPE ANCHOR STRING ONLY)					Cement Details	Top of Cement	
Size	Weight(s)	Grade (s)	Shoe at	CP at		Casing	Annulus
8 5/8	24#	K-55	619		345 cf "G" w 4% gel 3% CaCl2 Fld by 100 cf "G" w 3% CaCl2		SUR

BOP STACK							a	b	a/b	TEST DATA			
API Symb.	Ram Sz.	Mfr.	Model or Type	Size In.	Press Rtg.	Date Last Overhaul	Gal. to Close	Rec.Time Min.	Calc.GPM Output	psi Drop to Close	Secs.to Close	Test Date	Test Press
		H	Ram		3M							10-15	800
		S	Rams		"							"	1000
		S	CSO.		"							"	1000

ACTUATING SYSTEM

Accum.Unit(s) Wkg.Press. 3000 psi
Total Rated Pump Output _____ gpm
Distance From Well Bore 50+ ft.

	Mfr.	Accum. Cap.	Precharge
1	Koomey	80 gal.	1500 psi
2		gal.	Dry psi

CONTROL STATIONS	~~Elec.~~	Hyd.
✓ Manif. at accum.unit		✓
✓ Remote at Drlr's stn.	✓	
Other:		

EMERG. BACKUP SYST.	Press.	Wkg.Fl.
✓ N2 Cyl No: 3 Tpe:	1 —	gal
Other:	2 —	gal
	3 —	gal
	4	gal
	5	gal
	6	gal

AUXILIARY EQUIPMENT

	No.	Sz. (in)	Rated Press.	Connections Weld	Flan.	Thrd.
✓ Fill-Up Line						
✓ Kill Line						
✓ Control Valve(s)						
✓ Check Valve(s)						
✓ Auxil. Pump Connec.						
✓ Choke Line						
✓ Control Valve(s)						
✓ Pressure Gauge						
✓ Adjustable Choke(s)						
✓ Bleed Line						
✓ Upper Kelly Cock						
✓ Lower Kelly Cock						
✓ Standpipe Valve						
✓ Standpipe Pressure Ga.						
✓ Pipe Safety Valve						
✓ Internal Preventer						

HOLE FLUID MONITORING EQUIPMENT

	Alarm Aud.	Alarm ~~Vis.~~	Class
Calibrated Mud Pit			A
(✓) Pit Level Indicator	(✓)		B
Pump Stroke Counter			
Pit Level Recorder			C
Flow Sensor			
Mud Totalizer			
Calibrated Trip Tank			
Other:			

REMARKS: (1) No pit level indicator (B)

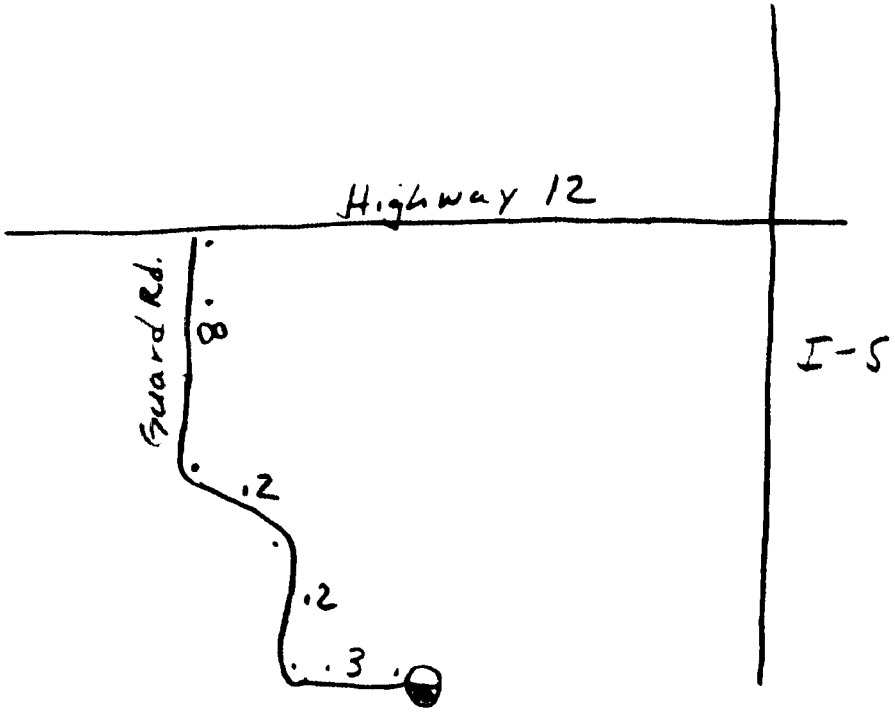
Hole Fluid Type	Weight	Storage-Pits

OGD 9(5-79-DWRR-3M)

Cal Pac Rig 3 Rated to 9000

First Hole!

5.1
5.4
5.6
5.5



DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 681-491

--
(field code)
--
(area code)
--
(new pool code)

(old pool code)

REPORT ON PROPOSED OPERATIONS

WELL CLASSIFICATION:
DEVELOPMENT

Harry Hull, Agent
ARGO PETROLEUM CORP.
P.O. Box CI
Ventura, CA 92001

Woodland, California
October 2, 1981

Your _____ proposal to drill well "Buttes-Rio Blanco" 15-77X, A.P.I. No. 077-20381, Proj. Section 15, T. 3N, R. 5E, M.D. B. & M., --- field, --- area, --- pool, San Joaquin County, dated 9-24-81, received 9-29-81 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 4 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The division is furnished copies of any draw down or back pressure tests performed. In addition the division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.

NOTE: 1. This well has been granted confidential status for two years from the date of its completion or abandonment.
2. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 300'.

Blanket Bond
KPH:kw
cc: Co., Ventura
CONFIDENTIAL STATUS

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this report and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

Form OG105 (8/80)

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

DIVISION OF OIL AND GAS RECEIVED SEP 29 1981 SACRAMENTO, CALIFORNIA

C.E.Q.A. INFORMATION			
EXEMPT X CLASS ____	NEG. DEC. ☐ S.C.H. NO. ____	E.I.R. ☐ S.C.H. NO. ____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION X
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
		✓	BB	✓	✓

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well BUTTES-RIO BLANCO 15-77X, API No. 077-21381 (Assigned by Division),

BFW ~300'± Proj. Sec. 15, T. 3N, R. 5E, M.D. B. & M., East Islands Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 293.5 acres, is as follows: (Attach map or plat to scale)

See attached plat

Do mineral and surface leases coincide? Yes X No ____. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 957.19' feet N (Direction) along section ~~property line~~ (Cross out one) and 1348.19' feet W (Direction) at right angles to said line from the SE corner of section ~~property~~ 15 (Cross out one) or

Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) at total depth: ____ feet ____ (Direction) and ____ feet ____ (Direction)

Elevation of ground above sea level 4 feet.

All depth measurements taken from top of KB (Derrick Floor, Rotary Table, or Kelly Bushing) that is 18' feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
8 5/8"	24#	K-55	Surface	600'	Surface	Surface (600')
4 1/2"	9.5#	J-55	Surface	5000'	5000'	4000'

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Meganos Sands 4500' 2100psi (Name, depth, and expected pressure) Estimated total depth 5000'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Name of Operator		Type of Organization (Corporation, Partnership, Individual, etc.)	
Argo Petroleum Corporation		Corporation	
Address 940 E. Santa Clara		City Ventura	Zip Code 93001
Telephone Number (805) 648-2514	Name of Person Filing Notice Harry Hull	Signature Harry Hull	Date 9-24-81

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: _____

Lead Agency Contact Person: _____

Address: _____

_____

Phone: ( ) _____

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? **Yes** ☐ **No** ☐
Remarks: _____

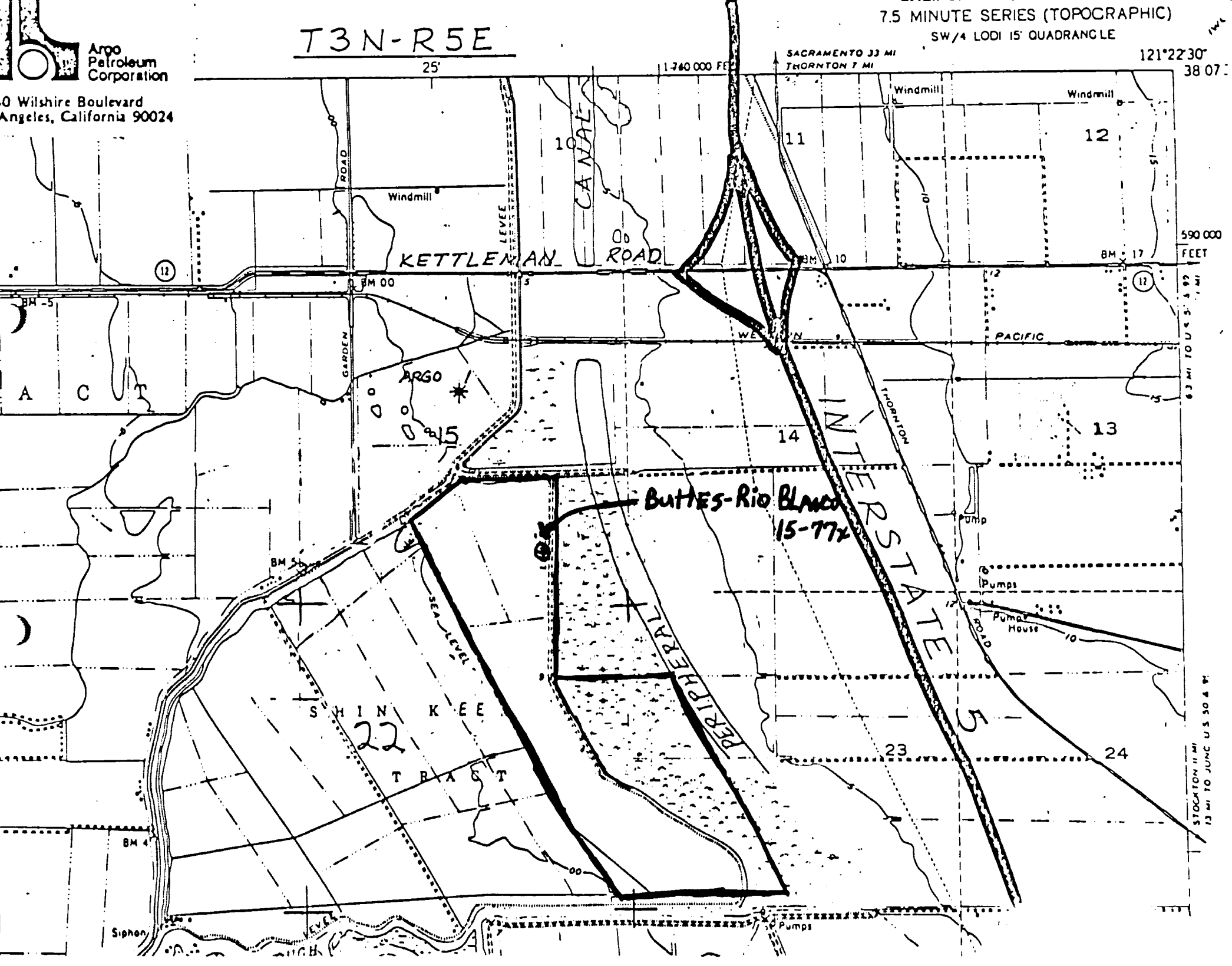
CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

Argo Petroleum Corporation
0 Wilshire Boulevard
Angeles, California 90024



Argo
Petroleum
Corporation

10880 Wilshire Boulevard
Los Angeles, California 90024

Telephone (213) 475-4976
Cable - Argpetro
Telex - 67-4080

September 24, 1981

Mr. John C. Sullivan
Division of Oil & Gas
117 W. Main, Suite #11
Woodland, California 95695

RE: CONFIDENTIAL STATUS

BUTTES-RIO BLANCO 15-77X

Dear Mr. Sullivan:

Confidential status is hereby requested for all records on the above-captioned well.

Thank you for your consideration in this matter.

Sincerely,

ARGO PETROLEUM CORPORATION

Harry Hull

Harry Hull
District Superintendent

HEH:ncg

cc: Dennis Bird

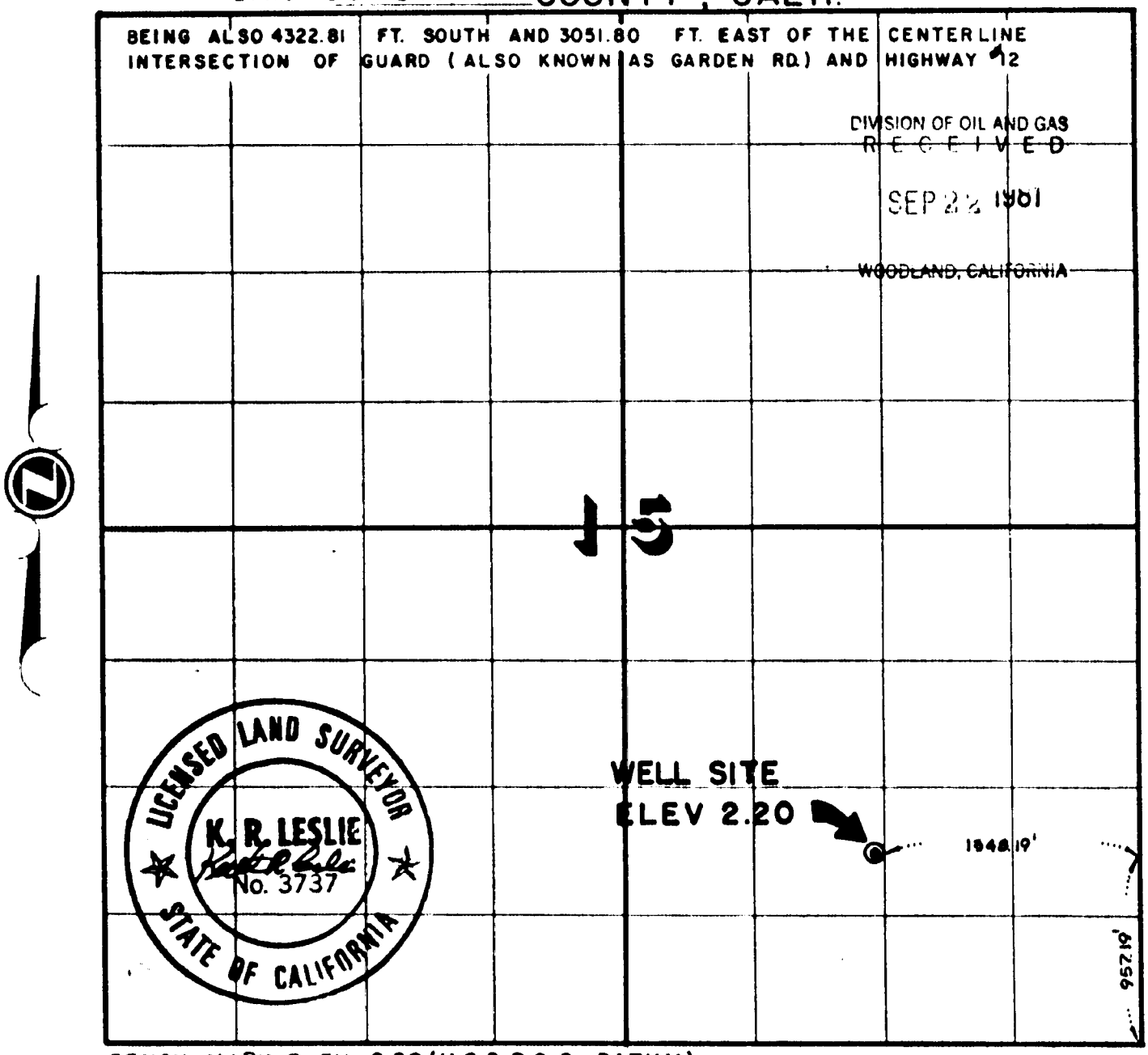
Hold for Motion

SKETCH OF WELL LOCATION FOR

ARGO PETROLEUM CORPORATION

WELL LOCATED 957.19 FT. NORTH ; 1348.19 FT. WEST OF S.E. CORNER PROJ. SEC. 15 T. 3 N., R. 5 E., M.D.B.&M.
SAN JOAQUIN COUNTY, CALIF.

BEING ALSO 4322.81 FT. SOUTH AND 3051.80 FT. EAST OF THE CENTERLINE INTERSECTION OF GUARD (ALSO KNOWN AS GARDEN RD.) AND HIGHWAY 12



BENCH MARK ELEV. 2.20 (U.S.C.&G.S. DATUM)

+ WELL

+ NONE CARDINAL REFERENCE POINTS

BUTTES-RIO BLANCO NO. 15-77 X
NAME OF WELL

LAUGENOUR AND MEIKLE
CIVIL ENGINEERS
WOODLAND

SCALE: 1" = 800'

DATE 9-22-81

Perrin #1

API No. 07700518

FORM 159 (9-49)

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, California

May 7, 1963

Mr. John R. Amundson
4412 Blomquist Drive
Bakersfield, California
Agent for FERGUSON & BOSWORTH

DEAR SIR:

077 00518

Your report of abandonment of Well No. "Perrin" 1, Sec. 19, T. 3 N, R. 6 E, M.D.B. & M., -- field, San Joaquin County, dated January 7, 1963, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

E. R. MURRAY-AARON
State Oil and Gas Supervisor

Bond No. 92-794179 dated 12-5-62
WJH:djs

By R. M. Barger
Deputy Supervisor

121 ✓

59444 2-62 6M SPO

MAP & BOOK

STATUS

Completed Producing _____
Recompleted Producing _____
Completed Abandoned _____
Uncompleted Abandoned ✓
Idle _____

RECORDS

Received		Needed
✓	Well Summary	
	History	
✓	Log & Core	
✓ Lge	Sm Elec. Log(s)	Lge Sm
	Direct. Survey	
	Other	

Location OK
Elevation OK
Release Bond
Hold Bond ____ Reason
Final letter
150b
170
121 ✓
card

Request additional copy of Forms 100 or 103 only not received

WJH 11-1-63

077 00513

1 Sonic - PW - 1977

WJH 2-6-63

Form 19

FORM 109-D

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Special Report on Operations Witnessed

No. T 662-437

Mr. John R. Amundson
Post Office Box 4248, Station B
Bakersfield, California
~~XXXXXXX~~ FERGUSON & BOSWORTH

Woodland, Calif.
December 26, 1962

DEAR SIR:

Operations at well No. "Perrin" 1, Sec. 19, T. 3 N., R. 6 E., M.D. B & M. ------ Field, in San Joaquin County, were witnessed on December 18, 1962, Mr. W. J. Hunter, representative of the supervisor was present from 6:00 P.M. to 6:20 P.M. There were also present M. Spivey, Drilling Foreman, and A. Rimer, Driller

Present condition of well: 9 5/8" cem. 502'. T. D. 4800' plugged with cement 600' - 434'

The operations were performed for the purpose of witnessing the location and hardness of a cement plug placed from 600' to 434' in the process of abandonment.

Mr. Spivey reported:

1. On December 14, 1962, 9 5/8" 32.30 lb. surface casing was cemented in a 13 3/4" hole at 502' with 265 sacks of (1:1) Perfalite and cement, and 4% gel; followed by 75 sacks of neat cement, all treated with 2% calcium chloride. Cement returned to the surface.
2. An 8 3/4" hole was drilled to 4800'.
3. No commercial gas showings were encountered.
4. On December 18, 1962, 100 sacks of cement mixed with 2% calcium chloride was pumped into the hole through drill pipe hanging at 600' calculated to fill to 321'.

THE ENGINEER NOTED that the cement plug at the depth of 434' supported all of the weight of the drill pipe.

THE LOCATION AND HARDNESS OF THE CEMENT PLUG AT 434' ARE APPROVED.

WJH: ffb

E. R. MURRAY-AARON
State Oil and Gas Supervisor

By R. M. Barger Deputy

56221 1-62 15M ® SPO

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 662-637

Mr. John R. Amundson
Post Office Box 4248, Station B
Bakersfield, California
FERGUSON & BOSWORTH

Woodland, Calif.
December 26, 1962

DEAR SIR:

Your proposal to abandon Well No. "Perrin" 1, Section 19, T3 N., R. 6 E., M.D. B. & M., ----- Field, San Joaquin County, dated Dec. 19, 1962, received Dec. 24, 1962, has been examined in conjunction with records filed in this office. Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:

"THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 4800'
2. Complete casing record, including plugs:
   H-40 casing 502' of 9-5/8" 32.30
   cemented with equivalent of 340 sacks
   cement.
3. Last Produced Never produced

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:
   None
5. Stratigraphic markers and depths:
   Domengine Sand 3673'
   Capay Shale 4442'
   Capital sand 4700'
6. Geologic age at bottom: Eocene-Paleocene
7. Base of fresh water sands: above 500'."

PROPOSAL:

"THE PROPOSED WORK IS

1. Fill hole with heavy mud. Hang open end drill pipe at 600' and cement back to 450'. Notify D.O.G. to witness top and hardness of plug.
2. Fill hole with heavy mud to within 14' of surface. Cement from 14' to 4' which is bottom of cellar. Cut off surface pipe even with bottom of collar and weld on steel plate. Abandon well in this condition."

DECISION:

THE PROPOSAL IS APPROVED.

E. R. MURRAY-AARON, State Oil and Gas Supervisor

By R. M. Barger, Deputy

Bond No. 92-794179 dated 12-5-62
RMB:ffb

54387 12-61 50M SPO

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
DEC 24 1962
WOODLAND, CALIFORNIA

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin; one copy only

Bakersfield Calif. December 19 1962

DIVISION OF OIL AND GAS

In compliance with Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon

Well No. Perrin #1, Sec. 19, T. 3N,

R. 6E, M.D. B. & M., Field, San Joaquin County,

commencing work on December 18 1962.

THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 4800'

2. Complete casing record, including plugs:

H-40 casing 502' of 9-5/8" 32.30 cemented with equivalent of 340 sacks cement.

3. Last Produced Never produced
(Date) (Oil, B/D) (Water, B/D)

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:

None

5. Stratigraphic markers and depths:

Domengine Sand	3673'
Capay Shale	4442'
Capital sand	4700'

6. Geologic age at bottom: Eocene-Paleocene

7. Base of fresh water sands: above 500'

THE PROPOSED WORK IS

1. Fill hole with heavy mud. Hang open end drill pipe at 600' and cement back to 450'. Notify D.O.G. to witness top and hardness of plug.

2. Fill hole with heavy mud to within 14' of surface. Cement from 14' to 4' which is bottom of cellar. Cut off surface pipe even with bottom of collar and weld on steel plate. Abandon well in this condition.

MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
[illegible]	[illegible]	✓	[illegible]	✓	[illegible]

P.O. Box 4248 Station B - Bakersfield California
(Address)

FA 7-0291
(Telephone No.)

FERGUSON & BOSWORTH
(Name of Operator)

By John R. Amundsen
John R. Amundsen - Engineer

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

FORM 100

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

SUBMIT IN DUPLICATE

DIVISION OF OIL AND GAS
RECEIVED
JAN 30 1963
WOODLAND, CALIFORNIA

Operator FERGUSON & BOSWORTH Well No. PERRIN #1

Sec. 19, T. 3N, R. 6E, M.D. B. & M. Field SAN JOAQUIN County.

Location 1120'N, 330'W OF SE COR.
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level 14.17 feet.

All depth measurements taken from top of KELLY BUSHING which is 12.50 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

In compliance with Sec. 3215, of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date JANUARY 7, 1963

Signed John R Amundsen
J. R. AMUNDSEN
Title ENGINEER
(Engineer or Geologist) (Superintendent) (President, Secretary or Agent)

Commenced drilling DECEMBER 14, 1962
Completed drilling DECEMBER 18, 1962
Total depth 4802' Plugged depth 434'
Junk NONE

GEOLOGICAL MARKERS	DEPTH
DOMINGENE SAND	3673'
CAPAY SHALE	4442'

Geologic age at total depth:

Commenced producing ABANDONED 12-18-62 (Date) Flowing/gas lift/pumping (Cross out unnecessary words)

Name of producing zone

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production	NONE					
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cem if through perf
9-5/8"	502'	SURFACE	32.30#	NEW	SMLESS	H-40	13-3/4"	340 SACK EQUIV.	

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

NONE

Electrical Log Depths 4802' (Attach Copy of Log)

SPO

FORM 103

SUBMIT IN DUPLICATE

STATE OF CALIFORNIA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR FERGUSON & BOSWORTH FIELD SAN JOAQUIN

Well No. PERRIN #1, Sec. 19, T. 3N, R. 6E, M.D. B. & M.

Date JANUARY 7, 1963 Signed J. R. AMUNDSEN

P.O. BOX 4248 STATION B FA-7-0291 Title ENGINEER

(Address) (Telephone Number) (President, Secretary or Agent)

BAKERSFIELD, CALIFORNIA

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data.

Date	
1962	
12-13	MOVED IN EQUIPMENT.
12-14	RIGGED UP AND SPUDDED IN WITH 13-3/4" BIT AND DRILLED TO 502'. RAN IN WITH 12 JOINTS OF 9-5/8" H-40 32.30# CASING, WITH LARKIN GUIDE SHOE AT 502'. CEMENTED CASING WITH 265 SACKS TYPE A CEMENT, 265 CUBIC FEET OF PERF-A-LITE AND 6 SACKS OF GEL WITH 75 SACKS NEAT CEMENT AROUND SHOE, ALL TREATED 2% CALCIUM CHLORIDE. CEMENT IN PLACE AT 11:17 P.M.
12-15	STOOD CEMENTED 8 HOURS, LANDED SURFACE PIPE, WELDED ON FLANGE AND INSTALLED BLOW-OUT PREVENTORS. TESTED PIPE RAMS, POSITIVE RAMS AND G.K. HYDRIL WITH 1500# FOR 15 MINUTES. TEST O.K. DRILLED-OUT PLUGS AT 2:00 P.M. WITH A CHRISTENSEN 8-3/4" DIAMOND DRAG BIT AND DRILLED TO 2212'. DEVIATION AT 1123' = 1° 30', 1608' = 2°, 2005' = 2° 30'.
12-16	INSTALLED BAROID GAS DETECTOR UNIT AT 2530'. DRILLED TO 3692' WITH DRAG BIT. PULLED-OUT, RAN IN WITH 8-3/4" REED 4T3J BIT AND DRILLED TO 3772'. DEVIATION 2497' = 2° 15', 2968' = 3°, 3376' = 5° 30', 3530' = 5°, 3692' = 5°.
12-17	DRILLED AHEAD WITH 8-3/4" BIT TO 4711'. DEVIATION 3772' = 5°, 3964' = 4°, 4245' = 4° 10', 4490' = 6° 15'.
12-18	DRILLED WITH 8-3/4" BIT TO 4802'. CONDITIONED HOLE AND PULLED-OUT. RAN SCHLUMBERGER I.E.S. LOG AND SONIC LOG. RAN IN WITH OPEN END DRILL PIPE TO 600'. EQUALIZED 100 SACKS OF TYPE A CEMENT ALL TREATED 2% CALCIUM CHLORIDE. CEMENT IN PLACE AT 1:43 P.M. STOOD CEMENTED 3 HOURS, FOUND TOP OF PLUG AT 434'. TOP OF PLUG AND HARDNESS WITNESSED AND OKAYED BY D.O.G. PLUGGED FROM 14' TO 4', WHICH WAS BOTTOM OF CELLAR, WITH CEMENT. CUT OFF CASING EVEN WITH BOTTOM OF CELLAR AND WELDED ON STEEL CAP. ABANDONED WELL IN THIS CONDITION.

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 662-607

Mr. John R. Amundson
Post Office Box 4248, Station B
Bakersfield, California
~~XXXXXX~~ FERGUSON & BOSWORTH

Woodland, Calif.
December 12, 1962

DEAR SIR:

Your proposal to drill Well No. "Perrin" 1, Section 19, T. 3 N., R. 6 E., M.D. B. & M., ------- Field, San Joaquin County, dated Dec. 5, 1962, received Dec. 10, 1962, has been examined in conjunction with records filed in this office. Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:

"Legal description of lease See Attached Schedule, Exhibit A of leased land. Well to be located on Parcel 5.
Location of Well: 1120 feet North along section line and 330 feet West at right angles to said line from the South East corner of section 19.
Elevation of ground above sea level ----- feet To be surveyed datum.
All depth measurements taken from top of Kelly Bushing which is 12.5 feet above ground."

PROPOSAL:

"PROPOSED CASING PROGRAM

Size of casing inches A.P.I.	Weight	Grade and Type	Top	Bottom	Cementing Depths
9 5/8	32.30	H-40	Surface	500	500
5 1/2	17	J-55	Surface	5500	5500

Intended zone or zones of completion: Capay - Eocene
It is understood that if changes in this plan become necessary we are to notify you immediately."

DECISION:

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 9 5/8" surface casing shall be cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. Mud fluid of sufficient weight and proper consistency to prevent blow-outs shall be used in drilling, and the column of mud fluid shall be maintained to the surface at all times, particularly while pulling the drill pipe.
3. Adequate blow-out prevention equipment shall be provided and maintained ready for operation at all times.
4. In the event the 5 1/2" casing is cemented below the surface casing, fresh waters shall be protected by cement behind the casing. Sufficient cement shall be used to fill to at least 100' above the base of fresh waters.
5. This Division shalo be notified:
   a. To inspect blow-out prevention equipment prior to drilling below a depth of 1000'.
   b. To witness tests of the 5 1/2" water shut-off immediately above the objective zones.

115

Bond No. 92-794179 dated 12-5-62
WJH:ffb

E. R. MURRAY-AARON, State Oil and Gas Supervisor

By R. M. Barger, Deputy

54257 12-61 50M SPO

STATE OF CALIFORNIA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

077-00518

16

Notice of Intention to Drill New Well

This notice and surety bond must be filed before drilling begins

Bakersfield Calif. December 5, 1962

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division III, Article 4, Public Resources Code, notice is hereby given that it is our intention to commence the work of drilling well No. Perrin No. 1, Sec. 19, T. 3N, R. 6E, M.D. B. & M., Field, San Joaquin County.

Legal description of lease See attached schedule, Exhibit A of leased land. Well to be located on Parcel 5.
(Attach map or plat to scale)

Location of Well: 1120 feet North (Direction) along ~~property~~ section line and 330 feet West (Direction) at right angles to said line from the South East corner of ~~property~~ section 19

Elevation of ground above sea level feet To be surveyed datum.

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table or Kelly Bushing) which is 12.5 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES A.P.I.	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS
9 5/8	32.30	H-40	Surface	500	500
5 1/2	17	J-55	Surface	5500	5500

Intended zone or zones of completion: Capay - Eocene

DIVISION OF OIL AND GAS RECEIVED DEC 10 1962 WOODLAND, CALIFORNIA

MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
		✓		✓	✓

077 00518

It is understood that if changes in this plan become necessary we are to notify you before running casing.

Address P. O. Box 4248, Station B

Telephone Number FA 7-0291

FERGUSON & BOSWORTH (Name of Operator)

By John R. Crumbaker

SEND ONE COPY OF NOTICE TO DIVISION OFFICE IN DISTRICT WHERE WELL IS LOCATED

EXHIBIT "A"

PARCEL 1: A portion of the Southeast Quarter of Section 18, Township 3 North, Range 6 East, M.D.B.&M., more particularly described as follows:

Beginning at the Southeast corner of said Section 18 and running thence North 0° 05' West along Section line 325 feet; thence Westerly to a point in the West line of Southeast Quarter of said Section 18, which point is 335 feet North of the Southwest corner of said Southeast Quarter of said Section 18; thense South along the West line of said Southeast Quarter of said Section 18, 335 feet to the Southwest corner of the Southeast Quarter of said Section 18; thence South 88° 12' East along the South line of said Section 18, 2639.4 feet to the point of beginning, and containing 20 acres, more or less.

PARCEL 2: The South one half of the Northwest one-quarter of Section 19, Township 3 North, Range 6 East, M.D.B.&M..

PARCEL 3: A portion of the Southwest Quarter of Section 19, Township 3 North, Range 6 East, M.D.B.&M., more particularly described as follows:

Beginning at the Northeast corner of the Southwest one-quarter of said Section; thence North 88° 17½' West, a distance of 613 feet; thence South 45° 00' East, along a fence to a point in the East line of said Southwest one-quarter, distant 595.4 feet South from the Northeast corner of said Southwest one-quarter, and the point of beginning; thence North along said East line of the Southwest one-quarter, a distance of 595.4 feet to the point of beginning.

PARCEL 4: The North half of the Northeast Quarter of Section 19, Township 3 North, Range 6 East, M.D.B.&M..

PARCEL 5: The Southeast Quarter of Section 19, Township 3 North, Range 6 East, M.D.B.&M..

PARCEL 6: All that portion of the East half of Section 30, Township 3 North, Range 6 East, M.D.B.&M., lying Northeasterly of the Northeasterly line of the New Thornton Road and containing 194.6 acres more or less.

PARCEL 7: A portion of the Northeast Quarter of Section 19, Township 3 North, Range 6 East M.D.B.&M., more particularly described as follows: Beginning at the Southeast corner of the Southwest Quarter of the Northeast Quarter of said Section thence in a Westerly direction along the South line of the said Southwest Quarter of the Northeast Quarter to the center of Section 19; thence in a Northerly direction along the West line of said Southwest Quarter of the Northeast Quarter to the Northwest corner of said Southwest Quarter of the Northeast Quarter; thence diagonally in a Southeasterly direction across the Southwest Quarter of the Northeast Quarter to the point of beginning, containing 20 acres more or less.

EXCEPTING FROM PARCELS 1, 3, 5 and 7 the following described portion of Section 19, Township 3 North, Range 6 East, M.D.B.&M.: Commencing at the Southeasterly corner of Section 19 and thence running along the Easterly line of Section 19, North 0° 0' West, 464.97 feet to the point of beginning, thence South 77° 50½' West, 620.87 feet; thence North 43° 59½' West, 3910.57 feet; thence North 0° 00' West, 245.70 feet; thence North 48° 12' East, 46.77 feet; thence South 88° 20' East, 228.86 feet; thence South 43° 58½' East, 3479.22 feet; thence South 89° 38' East, 643.66 feet; to a point on the Easterly line of Section 19 and thence running along the Easterly line of Section 19 South 0° 0' East 444.97 feet to the point of beginning.

077 00518

CONTINUED

Ratto #14-1

API No. 07720345

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to:

Division of Oil, Gas, and Geothermal Resources
801 K Street, MS 20-22
Sacramento, CA 95814-3530

OCT 25 2004

October 1, 2004
(date)

Effective date of transfer / acquisition October 1, 2004 (date), date of possession October 1, 2004 (if different),

Tri-Union Development Corporation (old operator), transferred

the following wells to TexCal Energy (GP) LLC (new operator)

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec. T. R.	API Number
All Wells			

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: _____

OLD OPERATOR	NEW OPERATOR
Tri-Union Development Corp (operator name)	TexCal Energy (GP) LLC (operator name)
801 Travis, Ste 2102 (address)	801 Travis, Ste 2102 (address)
Houston, TX 77002	Houston, TX 77002
Phone (713) 533-4000	Phone (713) 533-4000
By (signature) 22 OCT 04 (date)	By (signature) 22 OCT 04 (date)
Jeffrey T Janik (printed name) VP Operations (title)	Jeffrey T Janik (printed name) VP-COO (title)

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

OG30A (10/03/UCP/1M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF PROPERTY AND WELL TRANSFER

Field or county	District
SAN JOAQUIN COUNTY	6
Former owner	**Date**
REUNION ENERGY, CO.	08/16/96

Name and location of well(s)

"Island Farms, Inc." 1	29/3N/4E	077-20094
"Ensher et al" 1	18/1N/5E	077-20095
"George Lake" 1	9/2S/5E	077-20075
"Great Basins Furtado" 1	33/2S/6E	077-00366
"Grunsky" 1	18/1N/6E	077-00437
"Smythe" 1	31/2N/3E	077-00488
"Hackel Ferguson" 1	26/1S/4E	077-00311
"Ratto" 14-1	14/3N/5E	077-20345
"Baker" 1	33/1N/7E	077-00450

Description of the land upon which the well(s) is (are) located

Date of transfer, sale, assignment, conveyance, or exchange	New owner	Type of organization
5/24/96	TRI-UNION DEVEL. CORP.	CORPORATION
	Address 1100 Louisiana, Ste 2880 Houston, TX 77056	**Telephone No.** 713-627-9277

Reported by

Confirmed by Richard Bowman, President TRI-UNION DEVEL. CORP.

New operator new status (status abbreviation)	Request designation of agent
PA	
Old operator new status (status abbreviation)	**Remarks**
AB	NAME CHANGE ONLY

Deputy Supervisor	Signature
ROBERT A. REID	Robert A. Reid

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
Ab – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121	JR	8/16/96	Map and book		
Form ODG148			Notice to be cancelled		
New well cards			Bond status	✓	
Well records	✓		EDP files	✓	
Electric logs	✓				
Production reports					

OGD156 (2/85/DWRR/2M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF PROPERTY AND WELL TRANSFER

Field or county ALL COUNTIES	District 6
Former owner BUTTES RESOURCES CO.	Date 1/11/94
Name and location of well(s) (see attached list)	
Description of the land upon which the well(s) is (are) located	

Date of transfer, sale, assignment, conveyance, or exchange 12/7/93	New owner REUNION ENERGY COMPANY Address P O Box 307 Meridian, CA 95957	Type of organization CORP. Telephone No. (916) 696-2593

Reported by C. Van Duzer - BUTTES	
Confirmed by C. Van Duzer - REUNION	
New operator new status (status abbreviation) PA	Request designation of agent
Old operator new status (status abbreviation) AB	Remarks

Deputy Supervisor ROBERT A. REID	Signature Robert A. Reid

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
Ab – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book		
Form ODG148			Notice to be cancelled		
New well cards			Bond status		
Well records			EDP files		
Electric logs					
Production reports					

OGD156 (2/85/DWRR/2M)

"Ensher et al" 1	18/ 1N/5E	077-20095	San Joaquin Co.
"Grunsky" 1	18/ 1N/6E	077-00437	San Joaquin Co.
"Baker" 1	33/ 1N/7E	077-00450	San Joaquin Co.
"Amerada-Honegger" 1-34	34/ 2N/3E	013-00001	Contra Costa Co.
"Smythe" 1	31/ 2N/3E	077-00488	San Joaquin Co.
"Island Farms, Inc." 1	29/ 3N/4E	077-20094	San Joaquin Co.
"Ratto" 14-1	14/ 3N/5E	077-20345	San Joaquin Co.
"M.S. Salman" 1	24/ 5N/3E	067-20023	Sacramento Co.
"Cafarelli" 1	5/ 7N/2E	095-20097	Solano County
"Collier" 1	9/ 7N/2E	095-20110	Solano County
"Natomas" 1	4/10N/4E	101-00095	Sutter County
"Natomas" 2	5/10N/4E	101-00096	Sutter County
"American Unit 1" 1	12/11N/3E	101-00226	Sutter County
"Sanborn Unit 1" 5	19/15N/1E	101-20194	Sutter County
"Butte Community B" 1	4/15N/2E	101-00279	Sutter County
"Butte Community B" 5	4/15N/1E	101-00275	Sutter County
"Sutter City Community" A-7	9/15N/2E	101-00276	Sutter County
"Butte Community D" 1	15/16N/1E	101-00283	Sutter County
"Butte Community A" 1	9/16N/2E	101-00288	Sutter County
"Butte Community A" 2	9/16N/2E	101-00289	Sutter County
"Butte Community A" 4	9/16N/2E	101-00290	Sutter County
"Butte Community B" 2	22/16N/2E	101-00293	Sutter County
"Buttes" 8	28/16N/2E	101-00294	Sutter County
"Buttes" 10	31/16N/2E	101-00299	Sutter County
"Buttes Community B" 3	33/16N/2E	101-00298	Sutter County
"Justeson" 2	2/17N/1E	007-00085	Butte County
"Mobil-Robbins" 1	23/ 6N/1W	095-20039	Solano County
"Henshaw" 3	11/15N/1W	011-20088	Colusa County
"Spieler-Williams" 2	27/15N/1W	011-00261	Colusa County
"Haskell" 1	29/16N/1W	011-20090	Colusa County
"Corning Community" 9-A	6/23N/2W	103-00085	Tehama County
"Corning Community" 9-2	1/23N/3W	103-00094	Tehama County
"Wilkens" 1	8/24N/2W	103-00117	Tehama County
"Jewett Creek Unit 1" 1	19/24N/2W	103-00118	Tehama County
"Corning Community" 8-D	26/24N/3W	103-00122	Tehama County

"Wico-Blackburn" 1	26/24N/3W	103-00123	Tehama County
"Buttes-Costa" 1	31/ 1S/1W	013-00187	Contra Costa Co.
"Buttes-Otto" 1	31/ 1S/1W	013-00188	Contra Costa Co.
"Buttes-Wiedemann" 1	10/ 2S/1W	013-00191	Contra Costa Co.
"Buttes Freitas" 1	18/ 2S/1W	001-00005	Alameda Co.
"Hackel Ferguson" 1	26/ 1S/4E	077-00311	San Joaquin Co.
"City of Livermore" 1	27/ 2S/2E	001-20019	Alameda County
"George Lake" 1	9/ 2S/5E	077-20075	San Joaquin Co.
"Great Basins Furtado" 1	33/ 2S/6E	077-00366	San Joaquin Co.

Buttes Resources Company

A SUBSIDIARY OF BUTTES GAS & OIL CO.
5100 CALIFORNIA AVE., SUITE 224
BAKERSFIELD, CALIFORNIA 93309
(805) 327-9891

DIVISION OF OIL AND GAS
RECEIVED
DEC 1 1980

December 8, 1980

Division of Oil & Gas
117 W. Main Street, Suite #11
Woodland, CA-95695

Attention: Mr. John C. Sullivan
Deputy Supervisor

Gentlemen:

Re: Request for Confidential Status
Buttes Resources Company
Buttes-Ratto #14-1 Well
Sec. 14, T3N/R5E, MDB&M
San Joaquin County, Calif.

Please take the subject well off of Confidential Status as of December 8, 1980.

Thank you.

Very truly yours,

J. S. Dickerson
Agent

JSD/gs

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, California

April 7, 1980

Guy L. Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

Your report of abandonment of well "Ratto" 14-1 (Name and number),

A.P.I. No. 077-20345, Section 14, T. 3N, R. 5E, M.D. B. & M.,

---, field, San Joaquin County,

dated 11-6-79, received 11-21-79, has been examined in conjunction with records filed in this office, and we have determined that all of the requirements of this Division have been fulfilled.

Environmental inspection made and approved 3-19-80.

Blanket Bond
JC:kw
cc: Buttes Resources Co.
Denver, CO

CONFIDENTIAL STATUS

M. G. MEFFERD
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor

John C. Sullivan

OG159 (11-76-GSR1-8M)

CHECK LIST RECORDS RECEIVED AND WELL STATUS

Company Butler Resources Co. Well No. "Patti" 14-1

API No. 077-20345 Sec. 14, T. 3N, R. 5E, M.D. B.&M.

County San Joaquin Co. Field —

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	11-21-79
History (Form OG103)	✓
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	
2 ISF, Sonic 5"	1-10-80
2 Cont. Dip	✓
2 DIL-SFL 2"	✓
2 Sonic	✓

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Water Flood	
Abandoned - Oil		Steam Flood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole		Air Injection	
Producing - Gas		Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas		LPG Injection	
Gas-Open to Oil Zone		Observation	
Water Flood Source			

DATE

RECOMPLETED

REMARKS

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports ✓
10. Casing Record
11. Plugs
12. Surface Inspection
13. Production
14. E Well on Prod. Dir. Sur.

2 Computer Process 1-17-80
2 Strata-Mud 1-28-80

3/19/80
JTC

CLERICAL CHECK LIST

1. Location change (F-OGD165)
2. Elevation change ✓ (F-OGD165)
3. Form OGD121 ✓
4. Form OG159 (Final Letter) Yes.
5. Form OGD150b (Release of Bond) BJB
6. Duplicate logs to archives
7. Notice of Records due (F-OGD170)

Rec'd

RECORDS NOT APPROVED
Reason: ~~Need 2 copies of Stratigraphic Mud log. Need surface inspection.~~
All else OK JTC 1/18/80

RECORDS APPROVED JTC 4/1/80

RELEASE BOND
Date Eligible
(Use date last needed records were received.)

MAP AND MAP BOOK 79-5820

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (3-77-GSR1-4M)

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

NOV 21 1979

WOODLAND, CALIFORNIA

WELL SUMMARY REPORT

SUBMIT IN DUPLICATE

Operator Buttes Resources Company, Well No. L. E. Ratto #1, API No. 077-20345,

Sec. 14, T. 3N, R. 5E, M.D. B. & M., —— Field, San Joaquin County.

Location 660' South & 2020' East of Norhtwest corner of Section 14,
(Give surface location from property or section corner, or street center line and/or lambert coordinates)

T3N, R5E, . Elevation of ground above sea level 7 feet.

All depth measurements taken from top of Kelly Bushing which is 12 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

In compliance with Sec. 3215, Division 3 of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date November 6, 1979 Signed Charles H. Fry

Charles H. Fry Title Consultant
(Engineer or Geologist)

Commenced drilling October 30, 1979

Completed drilling November 4, 1979

Total depth (1st hole) 5820' (2nd) ____ (3rd) ____

Present effective depth P & A 11/5/79

Junk None

GEOLOGICAL MARKERS	DEPTH
Domengine	3,588'
Capay	4,412'
Top Gorge	4,548'
H & T	5,625'
Starkey	5,727'

Formation and age at total depth Starkey (U.Cret).

Commenced producing ____ (Date) Flowing/gas lift/pumping (Cross out unnecessary words)

Name of producing zone ____

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	Grade and Type of Casing	New or Second Hand	Size of Hole Drilled	Numbers of Sacks or Cubic Feet of Cement	Depth of Cementing if through perforations
8-5/8"	801'	surf.	24#	K-55, R-3, ST&C	New	12-1/4"	377 sx	thru shoe

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was the well directionally drilled? no If yes, show coordinates at total depth ____

Electrical log depths Schlumberger Dual Induction-SFL-Sonic 5809 TO 800' Other surveys Dipmeter 5809-3500' Stratigraphic Mud Log 801' — 5820'

ATTACH ONE COPY OF EACH LOG AND SURVEY

Form 120 (REV. 1-73)

662-4683
John Sub

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

API # 077-20345

OPERATOR Buttes Resources Company FIELD San Joaquin Co., California

Well No. L. F. Ratto #1, Sec. 14, T. 3N, R. 5E, M.D. B. & M.

Date November 6, 1979 Signed Charles H. Fry

(916) 482-2874 Title Consultant
(Telephone Number) (President, Secretary or Agent)

3465 American River Drive, Suite B
(Address)
Sacramento, CA 95825

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date	
0/30/79	Moving in H & C rig #5 and rigging up. Spudded 12-1/4" hole at 2:00 p.m.
0/31/79	Drilling 12-1/4" hole to 801'. Pulled out of hole and rigged up to run surface casing. Ran 21 jts. (801.49') of 8-5/8", 24#, K-55, 8 rd., R-3, St & C, new casing equiped with guide shoe (1.50') used stop ring and 1 centralizer in middle of shoe joint and latched over collars of 2nd & 4th joints. Welded on shoe and bottom of collars on first two joints and Baker locked bottom two joints. Ran 50 cubic feet of water ahead. B-J mixed and pumped 257 sacks of Class "G" pre-mixed with 4% gel and treated with 2% $CaCl_2$ followed by 120 sacks of Class "G" treated with 2% $CaCl_2$. Used top plug and displaced with 250 cubic feet of mud and 30 cubic feet of water. Had good cement returns to surface approximately 140 cubic feet. Bumped plug on fillup insert in top of shoe joint with 750 psi. Released pressure and insert holding. Cement in place at 4:30 a.m., casing landed at 801'.

CASING DETAILS

801.49'	8-5/8" csg.
1.50'	guide shoe
802.99'	
2.00'	up on hook
800.99'	Landing depth

Baker insert at 761' and centralizers at 781', 723', and 647'. Waited on cement 4 hrs. Cut off conductor and surface casing. Welded on 10" 900 series casinghead and tested weld with 3000 psi. Set in BOP equipment and nippled up. Tested casing and blindrams with 1200 psi. Made up 7-7/8" drill assembly and ran in hole. Tested pipe rams, hydril, and kelley cock with 1200 psi. BOP tests witnessed and approved by Jim Champion - DOG engineer. Tagged top of cement at 758'. Drilled out cement and shoe and started making new 7-7/8" hole at 6:30 p.m. Installed Stratigraphic mud logging unit from base of surface casing and to log to total depth.

1/ 1/79	Survey and wiped hole to shoe at 1686'. Survey and tripped for new bit at 1807'. Survey and tripped for new bit at 3044'.
1/ 2/79	Wipe hole 12 stands at 3970'. Survey and tripped for new bit at 4167'.

11/ 3/79 Wipe hole 10 stands at 4590'.
Survey and tripped for new bit at 4735'
Wiped hole 10 stands at 5145'

11/ 4/79 Survey and tripped for new bit at 5,540'.
Drilled 7-7/8" hole to total depth 5,820'. Made 20 stand wiper run, circulated hole clean, and pulled out of hole. Rigged up Schlumberger and started running logs at 7:00 p.m.
Ran Combination Dual Induction - SFL and Sonic log from 800' to 5803'.

Continuous dipmeter.
From 3500' to 5809'.

Release Stratigraphic mud logging unit at midnight.

11/ 5/79 Finished running Schlumberger logs and prepared to plug and abandoned well. Plugged well as follows:

1. Plug #1 (shoe) hung drill pipe at 846', B-J mixed, pumped, and equalized 60 sacks of Class "G" treated with 3% $CaCl_2$. Calculated to fill 200'. CIP at 8:55 a.m.. Wait on cement 3 hrs and located top of cement at 790'. Re-cemented, hung drill pipe at 790' and equalized 30 sacks of Class "G" with 3% $CaCl_2$. Calculated to fill to 695'. Cement in place at 11:50 a.m.. Plug approved by Jim Champion - DOG Engineer.
2. Plug #2 (fresh water) hung drill pipe at 249' and equalized 30 sacks Class "G" treated with 3% $CaCl_2$. Calculated fill to 153'. C.I.P. at 1:55 p.m.. Plug approved by Jim Champion-DOG Engineer.
3. Plug Top of Surface Casing. Hung drill pipe at 30' and equalized 10 sacks of Class "G" cement treated with 3% $CaCl_2$. Plug approved by Jim Champion DOG Engineer. Cut off casing at collar floor and weld on steel plate.

Laid down kelley, rat hole, mouse hole, tear out BOP. Clean mud tanks rig released at 10:00 p.m. 11/5/79.

MUD RECORD

DEPTH	WEIGHT (LB./CU.FT.)	GRADIENT (PSI/FT)	VISCOSITY (SEC/WT.)	PH	FILTRATE (ML/30MIN.)	SALT (PPM)	CALCIUM (PPM)
800'	Spud mud to suit contractor						
1700'	74	.514	43	8.5	8.0	650	100
2400'	77	.535	43				
3044'	77.5	.538	44				
4000'	76	.528	46	9.5	7.5	850	80
4150'	75	.521	42	11.0	7.5	850	80
4735'	77	.535	44	11.0	7.4	950	80
5540'	78.5	.545	43	11.0	7.0	900	80
5820'	79.5	.552	45	11.0	7.0	900	80

BIT RECORD

BIT NO.	SIZE	MAKE	TYPE	SER.NO.	NEW USED	DEPTH IN	DEPTH OUT	FEET	HOURS
1	12-1/4"	Reed	Y12J	123332	Buttes Re-run	0	801	801	10-1/2
2	7-7/8"	HTC	OSC3J	WL135	Buttes Re-run	801	1807	1006	10-1/2
3	7-7/8"	Reed	Y12J	747311	New	1807	3044	1237	8-1/4
4	7-7/8"	Smith	DTJ	AH3273	New	3044	4167	1123	14-1/2
5	7-7/8"	HTC	OSC3J	WJ935	New	4167	4735	568	11-1/2
6	7-7/8"	Reed	Y12J	547363	New	4735	5540	805	17-1/2
7	7-7/8"	HTC	OSC3J	WJ919	New	5540	5820	280	6

SURVEYS

DEPTH	INCLINATION	DEPTH	INCLINATION
801'	0° 45'	3044'	0° 45'
1600'	1° 15'	4735'	0° 45'
1807'	1°	5540'	0° 45'

CALIFORNIA
DIVISION OF OIL AND GAS

To: Guy Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

From: John C. Sullivan
DEPUTY SUPERVISOR
Division of Oil and Gas
117 W. Main St., Suite II
Woodland, CA 95695

Subject: ☒ Request for confidential status dated January 14, 1980.

☐ Request for extension of confidential status dated _____, 19___.

☒ Subject request is approved.

☐ Subject request is partially approved.

☐ Subject request is denied.

Records approved for confidential status are:

WELL NAME AND NUMBER	FIELD OR COUNTY	DATE ON WHICH RECORDS WILL BECOME PUBLIC
"Ratto"14-1 (077-20345) 14/3N/5E	San Joaquin County	Nov. 5, 1981

Remarks: _____

John C. Sullivan
(Signature)

JOHN C. SULLIVAN
(Name)

Deputy Supervisor
(Title)

1/17/80

Buttes Resources Company

A Subsidiary of Buttes Gas & Oil Co.

3100 19th Street, Suite 15
Bakersfield, California 93301
(805) 327-9891

DIVISION OF OIL AND GAS
RECEIVED
JAN 17 1980
WOODLAND, CALIFORNIA

January 14, 1980

Division of Oil & Gas
117 W. Main Street, Suite #11
Woodland, CA-95695

Attention: Mr. John C. Sullivan
Deputy Supervisor

Gentlemen:

Re: REQUEST FOR CONFIDENTIAL STATUS
Buttes Resources Company
Buttes-Ratto #14-1 Well
Sec. 14, T3N/R5E, MDB&M
San Joaquin County, Calif.

Pursuant to Section 3234 (a) Division 3, Public Resources Code, BUTTES RESOURCES COMPANY, as owner and operator, hereby requests confidential status of the Buttes Resources, Buttes-Ratto #14-1 Well until two years from date of completion or until the expiration of all extensions of confidential status.

In addition, attached for your file is subject well Computer Processed Log which you requested in your notice of January 11, 1980.

Very truly yours,

Guy L. Burge Jr.

Guy L. Burge, Jr.
Division Exploration Manager

Encl.

GLB/gs

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
117 WEST MAIN STREET, SUITE No. 11
WOODLAND, CALIFORNIA 95695
(916) 662-4683

January 11, 1980

Guy Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

Gentlemen:

This is in reference to logs filed in this office for your well "Ratto" 1, Sec. 14, T. 3N., R. 5E., M.D.B.&M., San Joaquin County which have "confidential" stamped on them.

It will be necessary for you to file a letter with this office requesting confidential status for the records if this is what you require.

Records will be held confidential pending receipt of a letter from you detailing your requirements for this well.

Very truly yours,

John C. Sullivan

JOHN C. SULLIVAN
Deputy Supervisor

rmc:

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 679-347

DIVISION OF OIL AND GAS

Report on Operations

Guy Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

Woodland Calif.
December 18, 1979

Your operations at well "Ratto" 14-1, API No. 077-20345, Sec. 14, T. 3N, R5E, M.D. B.& M. ---, Field, in San Joaquin Co. County, were witnessed on 11-5-79. J. Campion, representative of the supervisor, was present from 1100 to 1400. There were also present Al McGinnis, Drilling Foreman.

Present condition of well: 8 5/8" csg. 801'. TD 5820'. Plugged with cement 846'-790', 784'-688'±, 250'-152'± and 30'-5'.

The operations were performed for the purpose of abandonment.

DECISION

The plugging operations as witnessed and reported are approved.

KPH:kw
cc: Buttes Resources Co.

M. G. MEFFERD
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

OG109 (10-78-GSR1-15M)

DIVISION OF OIL AND GAS
Cementing/Plugging Memo

347

Operator Buttes Resources Co. Well No. Patto 1
API No. 077-20345 Sec. 14, T. 3N, R. 5E, MD B&M
Field _____, County San Joaquin. On 11-5-79,
Mr. J. Campion, representative of the supervisor was present from 1100 to 1400.
There were also present A. Mcburnie (D.F.)
Casing record of well: 8 5/8" cem. 801', TD 5820', plugged w/cem. 846'-790', 784'-688'±, 250'-152'± + 30'-5'.

The operations were performed for the purpose of abandonment

☐ The plugging/cementing operations as witnessed and reported are approved.
☐ The location and hardness of the cement plug @_____' is approved.

Hole size: 7 7/8" fr. 5' to 5820', _____" to _____' & _____" to _____'

Casing				Cemented			Top of Fill		Squeezed Away	Final Press.	Perfs.
Size	Wt.	Top	Bottom	Date	MO-Depth	Volume	Annulus	Casing			
8 5/8			801								

Casing/tubing recovered: _____" shot/cut at _____', _____', _____' pulled fr. _____';
_____" shot/cut at _____', _____', _____' pulled fr. _____'.

Junk (in hole): _____

Hole fluid (bailed to) at _____'. Witnessed by _____

Mudding	Date	Bbls.	Displaced	Poured	Fill	Engr.

Cement Plugs		Placing		Placing Witnessed		Top Witnessed			
Date	Sx./cf	MO & Depth		Time	Engr.	Depth	Wt/Sample	Date & Time	Engr.
11-5	60 sx	D.P.	846			790 *	Wt	11-5 1115	JTC
✓	30 sx	D.P.	784	1200	JTC	688±	calculated		
✓	30 sx	D.P.	250	1300	✓	152±	✓		
✓	10 sx	D.P.	30	1330	✓	5	sample		

* way too low - recement

OGD10 (2-77-GSR1-6M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 679-497

REPORT ON PROPOSED OPERATIONS

-- (field code)
-- (area code)
-- (pool code)

Guy L. Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

Woodland, California
December 18, 1979

Your _____ proposal to abandon well "Ratto" 14-1,
A.P.I. No 077-20345, Section 14, T. 3N, R. 5E, M.D. B. & M.,
--- field, --- area, --- pool,
San Joaquin County, dated 11-16-79, received 12-17-79 has been examined in conjunction with records filed in this office.

THE PROPOSAL, COVERING WORK ALREADY COMPLETED IN ACCORDANCE WITH PRIOR AGREEMENT, IS APPROVED.

THIS DIVISION SHALL BE NOTIFIED:

a. To inspect and approve the clean-up of the wellsite before approval of abandonment will be issued.

NOTE: RECORDS FOR WORK DONE UNDER THIS APPROVAL ARE DUE WITHIN 60 DAYS AFTER COMPLETION OF THE WORK AND/OR SUSPENSION OF OPERATIONS.

Blanket Bond
KPH:kw
cc: BUTTES RESOURCES CO.

3/19/80
JTC

A copy of this report must be posted at the well site prior to commencing operations.

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

OG111 (1-79-GSRI-5M)

DIVISION OF OIL AND GAS
RECEIVED
NOV 1979
WOODLAND, CALIFORNIA

DIVISION OF OIL AND GAS

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin.

FOR DIVISION USE ONLY			
CARDS	BOND	FORMS 114	FORMS 121
✓	6/12	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3229, Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon Well No. ~~L. E.~~ "Ratto" ~~#1~~ 14-1, API No. 077-20345,

Sec. 14, T. 3N, R. 5E, M.D. B. & M., —— Field, San Joaquin County.

commencing work on November 5, 1979.

The present condition of the well is:

1. Total depth: 5,820' driller

2. Complete casing record, including plugs and perforations:

8-5/8" cement with 377 sack thru shoe at 801' to surface

3. Last produced _____ (Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)

or

4. Last injected _____ (Date) (Water, B/D) (Gas, Mcf/D) (Surface pressure)

Additional data for dry hole (show depths)

5. Oil or gas shows none

6. Stratigraphic markers:

Domengine	3,588'
Capay	4,412'
Gorge	4,548'
H & T	5,625'
Starkey	5,727'

7. Formation and age at total depth: Starkey (U.Cret.)

8. Base of fresh water sands: 200'

The proposed work is as follows: To P & A

Plug #1 (Shoe plug) hang DP @ 851' and plug back to 651' with 60 sacks Class "G" with 3% $CaCl_2$

Plug #2 (Fresh water) hang DP inside 8-5/8" surface casing at 250' and plug back to 150' with 30 sacks Class "G" with 3% $CaCl_2$

Plug #3 (Top surface casing) hang DP at 30' and fill top of casing with 10 sacks Class "G" with 3% $CaCl_2$

Cut off surface casing at cellar floor and weld on steel plate.

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address 3127 19th Street (Street)

Bakersfield, CA 93301 (City) (State) (Zip)

Telephone Number (805) 327-0509

Buttes Resources Company (Name of Operator)

By [signature] (Name) 11/16/79 (Date)

Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG108 (12-73-GSR1-15M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 679-282

DIVISION OF OIL AND GAS

Report on Operations

Guy L. Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

Woodland Calif.
November 2, 1979

Your operations at well "Ratto" 14-1, API No. 077-20345, Sec. 14, T. 3N, R. 5E M.D. B.& M. ---, Field, in San Joaquin Co. County, were witnessed on 10-31-79. J. Campion, representative of the supervisor, was present from 1430 to 1530. There were also present Bill Camp, Drilling Foreman.

Present condition of well: 8 5/8" cem. 801'. TD 801' (standing cemented).

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION

The blowout prevention equipment and installation are approved.

KPH:kw

cc: Buttes Resources Co.

Charlie Fry / Campion 11-4-79

TD 5800'

No shows

Shoe 801 < 50' / 50'

BFW 200 < 100' across

75' surface

3/19/80
JTC

M. G. MEFFERD
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor

John C. Sullivan

OG109 (10-78-GSRI-15M)

DIVISION OF OIL AND GAS
BLOWOUT PREVENTION EQUIPMENT MEMO

T 28Z

Operator Buttes Resources Well Ratto 14-1 Field _____ County San Joaquin

SITS:	Date	Engineer	Time	Operator's Rep.	Title
1st	10/31/79	J. Campion	1430 to 1530	Bill Camp	D.F.
2nd			to		

Casing record of well: 8 5/8" cem. 801'. TD 801' (standing cem.).

OPERATION: Testing ~~(inspecting)~~ the blowout prevention equipment and installation.
DECISION: The blowout prevention equipment and installation are approved.

REQUIRED BOPE CLASS: III B 2M

Proposed Well Opns: _____ MPSP: _____ psi
Hole size: _____" fr. _____' to _____', _____" to _____' & _____" to _____'

CASING RECORD (BOPE ANCHOR STRING ONLY)					Cement Details	Top of Cement	
Size	Weight(s)	Grade (s)	Shoe at	CP at		Casing	Annulus
8 5/8	24	K-55	801		257 sx "G" w/4% gel + 2% CaCl; 180 sx "G" w/2% CaCl		surface

BOP STACK							a	b	a/b	TEST DATA			
API Symb.	Ram Sz.	Mfr.	Model or Type	Size In.	Oper. Press	Date Last Overhaul	Gal. to Close	Rec.Time Min.	Calc.GPM Output	psi Drop to Close	Secs.to Close	Test Date	Test Press
		Hydril	Bag									10-31	1100
		Shaffer	Ram									✓	1000
		Shaffer	Ram									✓	1500

ACTUATING SYSTEM

Accum.Unit(s) Wkg.Press. 1500 psi
Total Rated Pump Output _____ gpm
Distance From Well Bore 50 ft.

	Mfr.	Accum. Cap.	Precharge
1	Hydril	80 gal.	750 psi
2		gal.	psi

CONTROL STATIONS	Elec.	Hyd.
✓ Manif. at accum.unit		✓
✓ Remote at Drlr's stn.	✓	
Other:		

EMERG. BACKUP SYST.			Press.	Wkg.Fl.
✓ N2 Cyl	No:	Tpe:	1	gal
Other: STD			2	gal
			3	gal
			4	gal
			5	gal
			6	gal

AUXILIARY EQUIPMENT

	No.	Sz. (in)	Rated Press.	Connections Weld	Flan.	Thrd.	
✓ Fill-Up Line							
✓ Kill Line							
✓ Control Valve(s)							
✓ Check Valve(s)							
✓ Auxil. Pump Connec.							
✓ Choke Line							
✓ Control Valve(s)							
✓ Pressure Gauge							
✓ Adjustable Choke(s)							
✓ Bleed Line							
✓ Upper Kelly Cock							
Lower Kelly Cock							
✓ Standpipe Valve							
✓ Standpipe Pressure Ga.							
✓ Pipe Safety Valve							
✓ Internal Preventer							

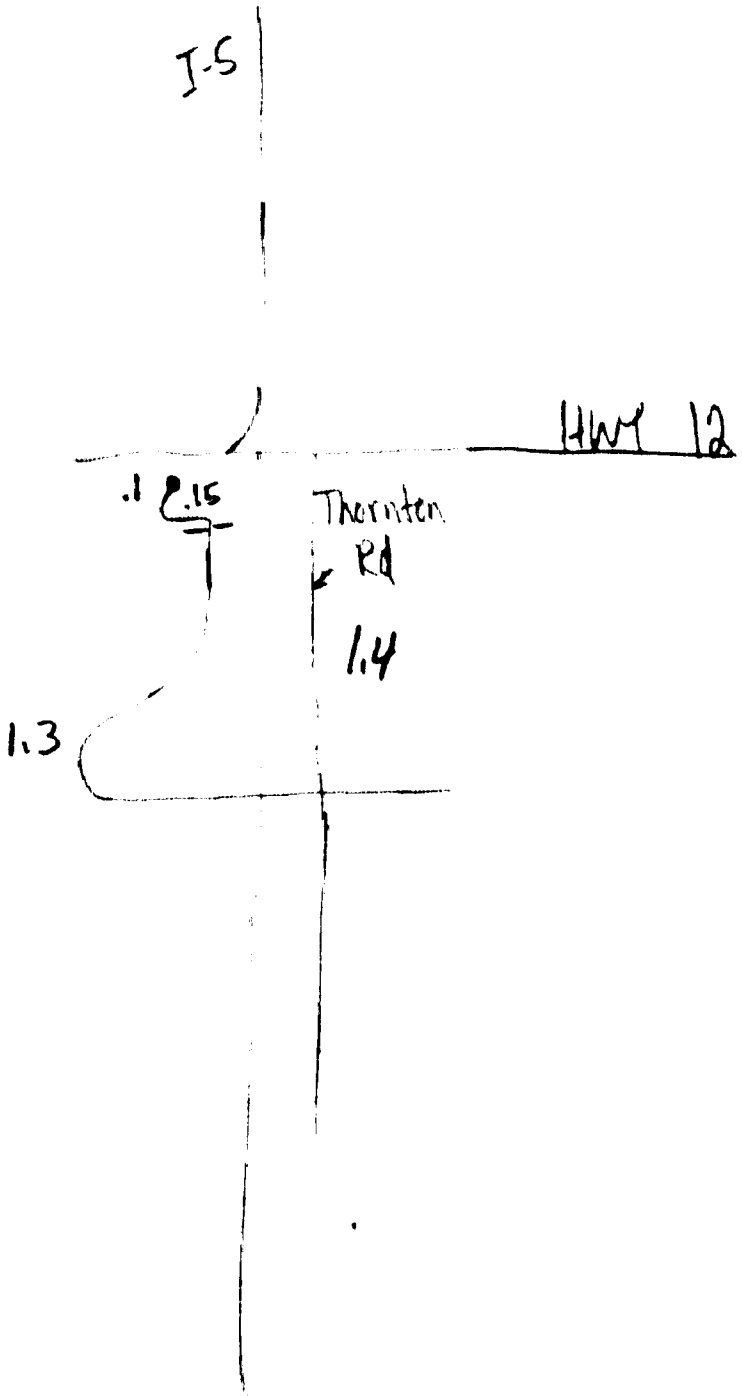
HOLE FLUID MONITORING EQUIPMENT

	Alarm Aud.	Alarm Vis.	Class
Calibrated Mud Pit			A
✓ Pit Level Indicator	✓	✓	B
Pump Stroke Counter			B
✓ Pit Level Recorder		✓	C
Flow Sensor			C
Mud Totalizer			C
Calibrated Trip Tank			C
Other:			

REMARKS: Need "P" report - told pusher.
No handle for upper kelly cock - told pusher to get

Hole Fluid Type	Weight	Storage-Pits

OGD9 (8-76-GSR1-2M)


I-5
HWY 12
.1
.15
Thornton
Rd
1.4
1.3

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 679-394

REPORT ON PROPOSED OPERATIONS

-- (field code)
-- (area code)
-- (pool code)

WELL CLASSIFICATION:
EXPLORATORY-NEW FIELD

Guy L. Burge, Jr., Agent
BUTTES RESOURCES CO.
3100 19th Street
Bakersfield, CA 93301

Woodland, California
October 29, 1979

Your _____ proposal to drill well "Ratto" 14-1, A.P.I. No. 077-20345, Section 14, T. 3N, R. 5E, M.D. B. & M., --- field, --- area, --- pool, San Joaquin County, dated 10-12-79, received 10-25-79 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 5 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 5 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.
   c. To witness a test of the 5 1/2" water shut-off.

NOTE: 1. RECORDS FOR WORK DONE UNDER THIS APPROVAL ARE DUE WITHIN 60 DAYS AFTER COMPLETION OF THE WORK AND/OR SUSPENSION OF OPERATIONS.
2. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 200'.

Blanket Bond
KPH:kw

cc: Company, Denver

A copy of this report must be posted at the well site prior to commencing operations.

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

OG111 (1-79-GSRI-5M)

Explor New Field BFW = 200'

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

DIVISION OF OIL AND GAS
RECEIVED
OCT 2 5 1979
WOODLAND, CALIFORNIA

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS____	NEG. DEC. ☒ S.C.H. NO.____	E.I.R. ☐ S.C.H. NO.____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☒
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
610	JC	✓	BB	✓	✓

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well ~~Buttes~~-Ratto #14-1, API No. 077-20345 (Assigned by Division),

Sec. 14, T. 3N, R. 5E, MD B. & M., _____ Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 71.55 acres, is as follows: See legal (Attach map or plat to scale)

description and plat attached hereto.

Do mineral and surface leases coincide? Yes X No____ If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 660' feet South (Direction) along section ~~/property~~ (Cross out one) line and 2020 feet East (Direction)

at right angles to said line from the Northwest corner of section ~~/Property~~ (Cross out one) 14 ~~XX~~

T3N-R5E, M.D.B.&M.

Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) at total depth: N/A feet (Direction) and _____ feet (Direction)

Elevation of ground above sea level 7 feet.

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table, or Kelly Bushing) that is 12 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING
8-5/8"	24	K-55-ST&G	Surface	800'	to surface	230 sacks
5-1/2"	15.5	K-55-ST&G	Surface	5800'		

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Mokelumne Sands, 4500'± 2,030± PSI (Name, depth, and expected pressure) Estimated total depth 5800'±

It is understood that if changes in this plan become necessary we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
Buttes Resources Company	Corporation	
Address: 3100 19th Street, Suite 15	City: Bakersfield	Zip Code: 93301
Telephone Number: (805) 327-9891 / Name of Person Filing Notice: Guy L. Burge, Jr.	Signature: Guy T Burge Jr	Date: 10/12/79

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

OG105 (7-78-GSR1-3M)

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: _____

Contact Person: _____

Address: _____

_____

Phone: ( ) _____

FOR DISTRICT USE
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks: _____

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

BFW = -300 USGS
-300± DWR
Chevron "Joe Cotton Properties Inc" | BFW = 170±
Use 300'

28-55
55-150-02, 18 & Ptn. State property

That portion of the following described property lying North of the North line of the Western Pacific Railroad Company property as acquired by deed recorded August 13, 1927, in Vol. 191 of Official Records, Page 358, San Joaquin County Records, and described as follows:

A tract of land situated in the County of San Joaquin, State of California in Sections 14 and 15, Township 3 North, Range 5 East, M. D. B. & M., more particularly described as follows:

COMMENCING at a point in the North line of Section 13, Township 3 North, Range 5 East, M. D. B. & M,,bearing Westerly 2352.5 feet from the Northeast corner of said Section 13; thence South 0° 10' East 1865.7 feet to an iron pipe at property corner; thence along property line, South 89° 31' West 2238.0 feet to an iron pipe at property corner; thence along property line, South 0° 10' East 1374.5 feet to an iron pipe at the Southeast corner of the Vail property; thence along the South line of Vail property South 89° 31' West 1082.7 feet to an iron pipe at fence corner at the true point of beginning of the following described 474 acre tract; thence from said true point of beginning along the South line of the Vail property, as follows: South 89° 31' West 2365.0 feet; South 89° 25' West 4402.8 feet to an iron pipe; due South 19.14 feet to an iron pipe; South 89° 25' West 847.0 feet to an iron pipe at the most Southerly corner of the 171.75 acre tract conveyed to R. C. Coldani by deed recorded in Book of Official Records of San Joaquin County, Vol. 231, Page 331; thence along the East line of said 171.75 acre tract, as follows: North 15° 23' East 155 feet, North 46° 57' East 1220 feet, North 29° 10' East 190 feet, North 7° 01' East 230 feet, North 0° 13'West 1960 feet to a point in the center line of the Terminous Road; thence along the center line of the Terminous Road, North 89° 54' East 6025 feet to an iron spike in pavement in line with fence Northerly and Southerly; thence along fence line, South 9° 28' East 3299 feet to the true point of beginning and containing, exclusive of the land deeded to the Western Pacific Railroad Company, which is excepted herefrom, 474 acres, more or less.

EXCEPTING THEREFROM that portion thereof conveyed to County of San Joaquin for a public road by deed recorded May 18, 1944 in Vol. 674 of Official Records, Page 344, San Joaquin County Records.

ALSO EXCEPTING THEREFROM all that portion lying East of Thornton Road.

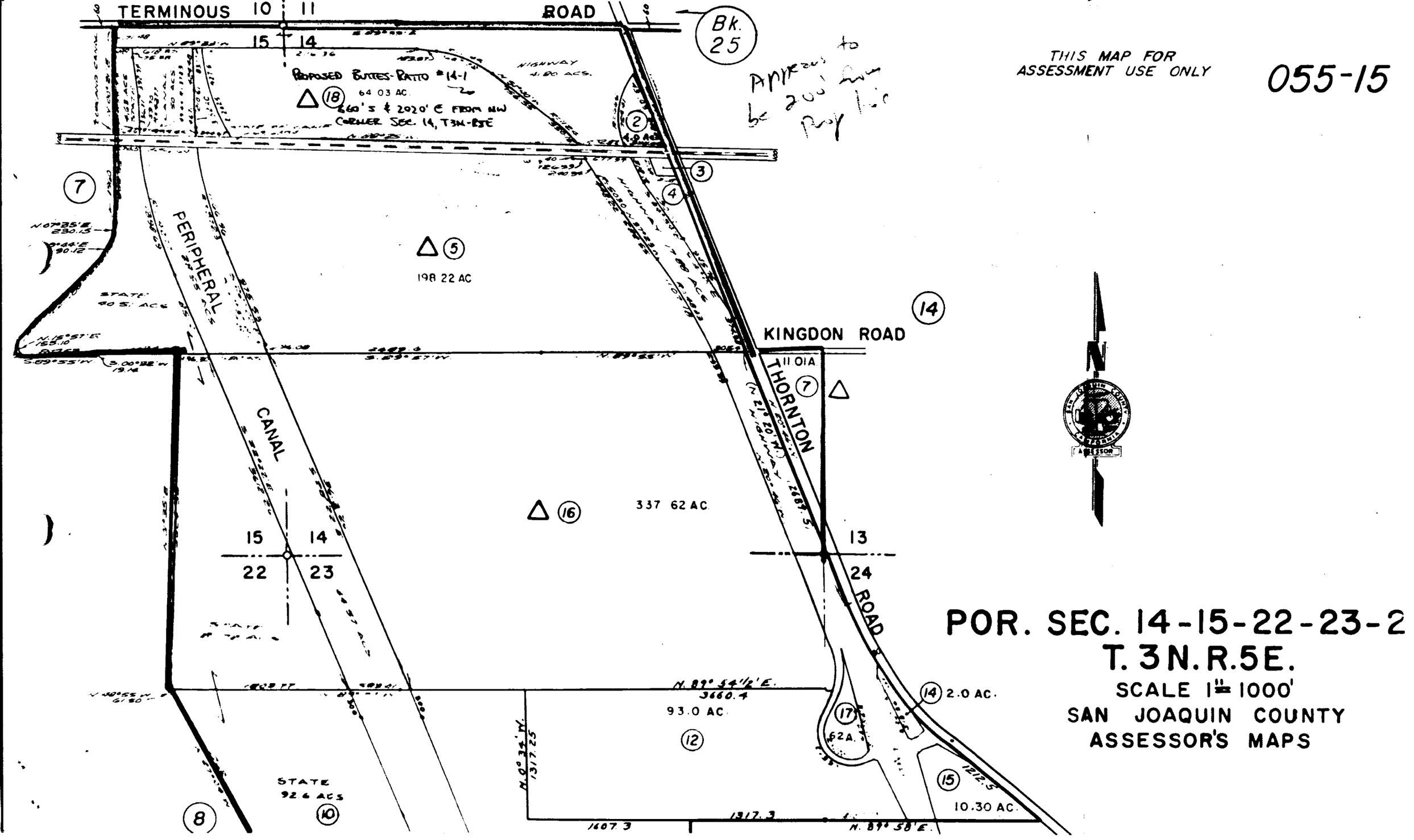
ALSO EXCEPTING THEREFROM the following:

(1) That certain parcel of land, containing 39.37 acres more or less, in addition to those portions in the included public ways, conveyed to the State of California in deed recorded January 6, 1970 in Vol. 3362 of Official Records, Page 441, Records of San Joaquin County.

(2) Those certain parcels of land, containing 11.50 acres, more or less, and 4.63 acres, more or less, conveyed to the State of California in deed recorded January 6, 1970 in Vol. 3362 of Official Records, Page 652, Records of San Joaquin County.

(3) That certain parcel of land, containing 2.43 acres, more or less, conveyed to the State of California in deed recorded February 6, 1970 in Vol. 3370 of Official Records, page 86. Records of San Joaquin County.

EXHIBIT "A"


TERMINOUS ROAD
Bk. 25
THIS MAP FOR ASSESSMENT USE ONLY
055-15
PROPOSED BUTTES-RATTO #14-1
64.03 AC.
660' S & 2020' E FROM NW CORNER SEC. 14, T3N-R5E
HIGHWAY 4.60 ACS.
198.22 AC
PERIPHERAL CANAL
STATE 90.5 ACS
KINGDON ROAD
THORNTON ROAD
11.01A
337.62 AC.
93.0 AC.
2.0 AC.
62A.
10.30 AC.
STATE 92.6 ACS
N. 89° 54½' E.
3660.4
N. 0° 34' W.
1317.25
1607.3
1317.3
N. 89° 58' E.
POR. SEC. 14-15-22-23-2
T. 3N. R.5E.
SCALE 1" = 1000'
SAN JOAQUIN COUNTY
ASSESSOR'S MAPS

Piancentine #1-27
API No. 07720484

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF PROPERTY AND WELL TRANSFER

Field or County **King Island Gas (San Joaquin Co.)**		District **District 6**
Former owner **Sierra Resources, Inc.**	Operator code **S3525**	Date **December 9, 2004**

Name and location of well(s)
"Piacentine" 1-27 (077-20484)
27/3N/5E

Description of the land upon which the well(s) is (are) located
See attachment A.

Date of transfer, sale, assignment, conveyance, or exchange **12/1/04**	New owner **Princeton Natural Gas**	Operator code **P4675**	Type of organization
	Address **34184 Pacific Coast Highway, Ste. C** **Dana Point, CA 92629**		Telephone No. **(858) 775-9897**

Reported by
Robert D. Eberts, President, Sierra Resources, Inc.

Confirmed by
Pat Ross, President, Princeton Natural Gas, LLC.

New operator new status (status abbreviation) **PA**	Request designation of agent **Pat Ross** **34184 Pacific Coast Highway, Ste. C** **Dana Point, CA 92629**
Old operator new status (status abbreviation) **PA**	Remarks

Deputy Supervisor **Robert S. Habel**	Signature Robert S Habel

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
AB – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book	RSH	12-10-04
Form OGD140			Notice to be cancelled	—	
New well cards	—		Bond status	RSH	12-10-04
Well records			EDP files	RSH	12-10-04
Electric logs			Computer Files	RSH	12-10-04
Production reports	—				

OGD156 (5/98)

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to:

Division of Oil, Gas, and Geothermal Resources
801 "K" Street, 20th Floor - MS 22
Sacramento, CA 95814-3530

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 01 2004
Sacramento, California

11/15/04
(date)

Effective date of transfer / acquisition 12/01/04 (date), date of possession 12/01/04 (if different),

Sierra Resources, Inc. (old operator), transferred

the following wells to Princeton Natural Gas LLC (new operator)

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec.	T.	R.	API Number
Piacentine #1-27 Well (Including all associated surface & downhole equipment)	King Island Field San Joaquin Co.	27	3N	5E	04-077-20484

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: See attached Exhibit "A"

OLD OPERATOR

Sierra Resources, Inc. (S3575)
(operator name)

P.O. Box 2788
(address)

Mammoth Lakes, CA 93546

Phone (760) 934-3356

By Robert D. Eberts 11/15/04
(signature) (date)

Robert D. Eberts President
(printed name) (title)

NEW OPERATOR

Princeton Natural Gas LLC (P4675)
(operator name)

34184 Pacific Coast Highway, Suite C
(address)

Dana Point, CA 92629

Phone (858) 775-9897

By 11/24/04
(signature) (date)

Pat Ross President
(printed name) (title)

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

Exhibit "A"

LEASE NUMBER:	29955-00
LESSOR:	PIACENTINE, FRED, A WIDOWER
LESSEE:	TENNECO OIL COMPANY
EFFECTIVE DATE:	DECEMBER 7, 1983
RECORDED SAN JOAQUIN CO.:	INSTRUMENT #83-88905, AMENDED BY INSTRUMENT #86-65563
LEASE DESCRIPTION:	T-3-N, R-5-E: PARCEL 1: THAT PORTION OF SECTIONS 27, 28, 29, 32, 33 AND 34, ALSO REFERRED TO AS KING ISLAND DESCRIBED AS FOLLOWS: COMMENCING AT A POINT NEAR THE WEST END OF THE HIGHWAY BRIDGE CROSSING BISHOP CUT, SAID POINT BEING MARKED BY A RAILROAD SPIKE, STAMPED R. E. 2909, DRIVEN INTO THE PAVEMENT OF THE G. A. ATHERTON ROAD NO. 550, SAID POINT OF COMMENCEMENT BEING SOUTH 88° 23' 30" WEST, 14,048.79 FEET, MORE OR LESS, FROM THE SOUTHEAST CORNER OF SECTION 36, TOWNSHIP 3 NORTH, RANGE 5 EAST, M.D.B.&M; THENCE RUNNING FROM POINT TO POINT ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 14' WEST, 1,796.64 FEET; NORTH 1° 57' WEST, 389.90 FEET; NORTH 0° 43' WEST, 479.10 FEET TO THE POINT OF BEGINNING SAID POINT OF BEGINNING BEING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 43' WEST, 2,351.90 FEET; NORTH 8° 47' EAST, 144.75 FEET; NORTH 25° 03' EAST, 425.71 FEET, MORE OR LESS, TO A POINT LYING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE EXISTING DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE EXISTING DRAINAGE DITCH, SOUTH 88° 18' 10" WEST, 1,823.99 FEET MORE OR LESS, TO THE POINT OF INTERSECTION WITH THE CENTERLINE OF THE DRAINAGE CANAL RUNNING IN A WESTERLY DIRECTION; THENCE RUNNING ALONG THE CENTERLINE OF THE "WESTERLY" DRAINAGE CANAL, SOUTH 89° 15' WEST, 6,153.62 FEET TO THE POINT OF INTERSECTION OF THREE PRESENT DRAINAGE CANALS; THENCE RUNNING IN A SOUTHERLY DIRECTION ALONG THE CENTERLINE OF A PRESENT DRAINAGE CANAL, SOUTH 0° 43-1/2' EAST, 2,758.54 FEET TO THE POINT OF INTERSECTION WITH THE PROLONGED CENTERLINE OF A PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE PRESENT DRAINAGE DITCH, NORTH 89° 54-1/2' EAST, 7,708.46 FEET TO THE POINT OF BEGINNING. PARCEL 2: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL 1 AND THE OUTER TOE OF THE LEVEE, AS SAID LEVEE IS DESCRIBED IN PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS. PARCEL 3: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS (THE OUTER TOE OF THE LEVEE ON THE WEST SIDE OF BISHOP CUT), AND A LINE PARALLEL TO AND 200 FEET EASTERLY FROM THE SAID EASTERLY BOUNDARY OF PARCEL 2. SAID PARCELS OF SAID LEASE HEREIN REFERRED TO, CONSTITUTE ALL OF THE LAND CONVEYED TO FRED PIACENTINI BY DEEDS RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS.

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 01 2004
Sacramento, California

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to:

11/15/04
(date)

Division of Oil, Gas, and Geothermal Resources
801 "K" Street, 20th Floor - MS 22
Sacramento, CA 95814-3530

Effective date of transfer / acquisition 12/01/04 (date), date of possession 12/01/04 (if different),

Sierra Resources, Inc. (old operator), transferred

the following wells to Princeton Natural Gas LLC (new operator)

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec.	T.	R.	API Number
Piacentine #1-27 Well (Including all associated surface & downhole equipment)	King Island Field San Joaquin Co.	27	3N	5E	04-077-20484

Div. of Oil & Gas - Dist. 6
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DEC 01 2004
Sacramento, California

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: See attached Exhibit "A"

OLD OPERATOR

Sierra Resources, Inc.
(operator name)

P.O. Box 2788
(address)

Mammoth Lakes, CA 93546

Phone (760) 934-3356

By (signature) 11/15/04 (date)

Robert D. Eberts (printed name) President (title)

NEW OPERATOR

Princeton Natural Gas LLC
(operator name)

34184 Pacific Coast Highway, Suite C
(address)

Dana Point, CA 92629

Phone (858) 775-9897

By (signature) 11/24/04 (date)

Pat Ross (printed name) President (title)

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

Exhibit "A"

LEASE NUMBER: 29955-00
LESSOR: PIACENTINE, FRED, A WIDOWER
LESSEE: TENNECO OIL COMPANY
EFFECTIVE DATE: DECEMBER 7, 1983
RECORDED SAN JOAQUIN CO.: INSTRUMENT #83-88905, AMENDED BY INSTRUMENT #86-65563
LEASE DESCRIPTION: T-3-N, R-5-E: PARCEL 1: THAT PORTION OF SECTIONS 27, 28, 29, 32, 33 AND 34, ALSO REFERRED TO AS KING ISLAND DESCRIBED AS FOLLOWS: COMMENCING AT A POINT NEAR THE WEST END OF THE HIGHWAY BRIDGE CROSSING BISHOP CUT, SAID POINT BEING MARKED BY A RAILROAD SPIKE, STAMPED R. E. 2909, DRIVEN INTO THE PAVEMENT OF THE G. A. ATHERTON ROAD NO. 550, SAID POINT OF COMMENCEMENT BEING SOUTH 88° 23' 30" WEST, 14,048.79 FEET, MORE OR LESS, FROM THE SOUTHEAST CORNER OF SECTION 36, TOWNSHIP 3 NORTH, RANGE 5 EAST, M.D.B.&M; THENCE RUNNING FROM POINT TO POINT ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 14' WEST, 1,796.64 FEET; NORTH 1° 57' WEST, 389.90 FEET; NORTH 0° 43' WEST, 479.10 FEET TO THE POINT OF BEGINNING SAID POINT OF BEGINNING BEING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 43' WEST, 2,351.90 FEET; NORTH 8° 47' EAST, 144.75 FEET; NORTH 25° 03' EAST, 425.71 FEET, MORE OR LESS, TO A POINT LYING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE EXISTING DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE EXISTING DRAINAGE DITCH, SOUTH 88° 18' 10" WEST, 1,823.99 FEET MORE OR LESS, TO THE POINT OF INTERSECTION WITH THE CENTERLINE OF THE DRAINAGE CANAL RUNNING IN A WESTERLY DIRECTION; THENCE RUNNING ALONG THE CENTERLINE OF THE "WESTERLY" DRAINAGE CANAL, SOUTH 89° 15' WEST, 6,153.62 FEET TO THE POINT OF INTERSECTION OF THREE PRESENT DRAINAGE CANALS; THENCE RUNNING IN A SOUTHERLY DIRECTION ALONG THE CENTERLINE OF A PRESENT DRAINAGE CANAL, SOUTH 0° 43-1/2' EAST, 2,758.54 FEET TO THE POINT OF INTERSECTION WITH THE PROLONGED CENTERLINE OF A PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE PRESENT DRAINAGE DITCH, NORTH 89° 54-1/2' EAST, 7,708.46 FEET TO THE POINT OF BEGINNING. PARCEL 2: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL 1 AND THE OUTER TOE OF THE LEVEE, AS SAID LEVEE IS DESCRIBED IN PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS. PARCEL 3: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS (THE OUTER TOE OF THE LEVEE ON THE WEST SIDE OF BISHOP CUT), AND A LINE PARALLEL TO AND 200 FEET EASTERLY FROM THE SAID EASTERLY BOUNDARY OF PARCEL 2. SAID PARCELS OF SAID LEASE HEREIN REFERRED TO, CONSTITUTE ALL OF THE LAND CONVEYED TO FRED PIACENTINI BY DEEDS RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS.

Div. of Oil & Gas - Dist. 6
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DISTRICT 6—WELL RECORDS CHECK LIST

COMPANY: _____ WELL NO.: _____

API: 077 - 04189 NOTICE FOR : ☐ drill ☐ rd ☒ rw ☐ abd

P-date(s) _____

RECORDS RECEIVED

	DATE	OK	Copies to IHS	NEEDS	NORD	REMARKS
Well Summary (OG100)..						
History (OG103)						
Directional Survey.....						
E-logs (2").....						
E-logs (5").....						
MUD Logs.....						
CBL.....						
Other_____						

☐ CONFIDENTIAL
RELEASE DATE_____

Bond Release _____Date_____

STATUS

Producing—Oil	____	Water Disposal	____
Idle—Oil	____	Waterflood	____
Abandoned-Oil	____	Steamflood	____
Drilling—Idle	____	Fire Flood	____
Abandoned-Dry hole	____	Air Injection	____
Producing—Gas	____	Gas Injection	____
Idle—Gas	____	CO2 Injection	____
Abandoned-Gas	____	LPG Injection	____
Gas—Open to Oil Zone	____	Observation	____
Gas Storage	____	Waterflood Source	____

DATE _____

REMARKS: _____

_____

ABANDONMENTS

Map Made for Surface Inspection _____

☐ **Surface Inspection** NEEDED
Completed_____

☐ **Final Letter** NEEDED
Completed_____

MAP # _____ BY:_____ DATE _____

DATABASE BY:_____ DATE _____

3/1/02

RECORDS APPROVED

BY: _____ DATE _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

2 Hidden Lake Circle
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637
e-mail: sri@qnet.com

Signed: Robert D. Eberts
Robert D. Eberts, President

Date: 1/17/02

RECOMPLETION HISTORY

DATE	REMARKS
11/28/01	Found well flowing to sales line. Shut in well with 550 psi FTP. R/U Halliburton wireline and ran in hole with 1-11/16" 6 SPF "wide angle" deep star gun and perforated 4676 - 4682' DIL with no change in well pressure. POOH and rig down Halliburton wireline unit. Left well shut in for buildup pressure.
11/29/01	Opened well - 700 psi on tubing and casing. Returned well to production with no change in production. Zone very tight with limited flow potential -- evaluating abandonment due to break even economics at current gas prices.

Div. of Oil & Gas - Dist. 6
RECEIVED
JAN 23 2002
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 601-577

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
05 (new pool code)
05 (old pool code)

Mr. Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
P.O. Box 2788
Mammoth Lakes, CA 93546-2788

Sacramento, California
November 26, 2001

Your _____ proposal to Rework well "Piacentine" 1-27
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B.&M.
King Island Gas field, any area Mokelumne pool
San Joaquin County, dated 11/10/2001, received 11/16/2001 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 3M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 3M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. **THIS DIVISION IS NOTIFIED:**
   a. In the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks, they shall be promptly reported to this district office.
   b. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   c. To inspect the installed blowout prevention equipment prior to commencing operations.

Blanket Bond
BW/jc
Enc(2)

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert S. Habel
Robert S. Habel, *Deputy Supervisor*

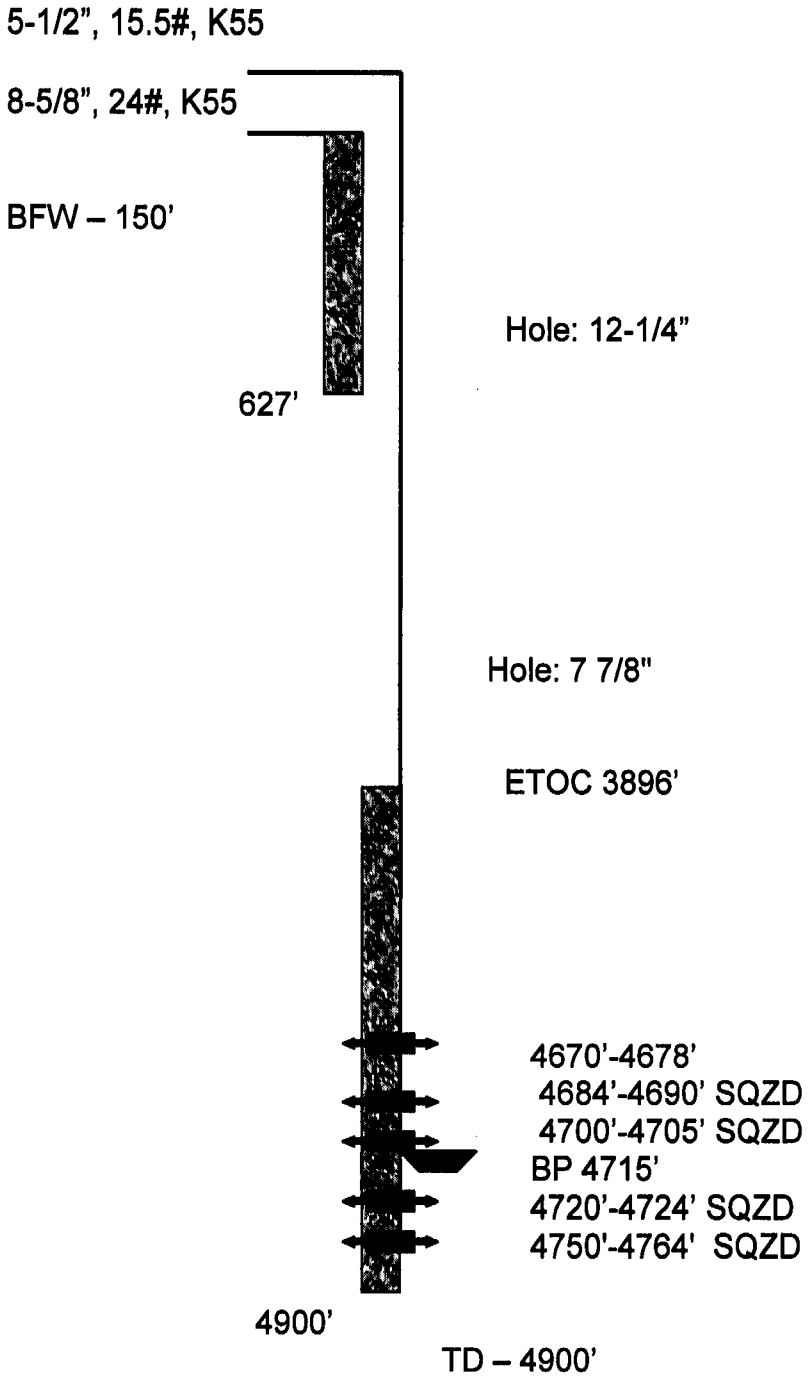
Engineer Bill Winkler
Phone (916) 322-1110

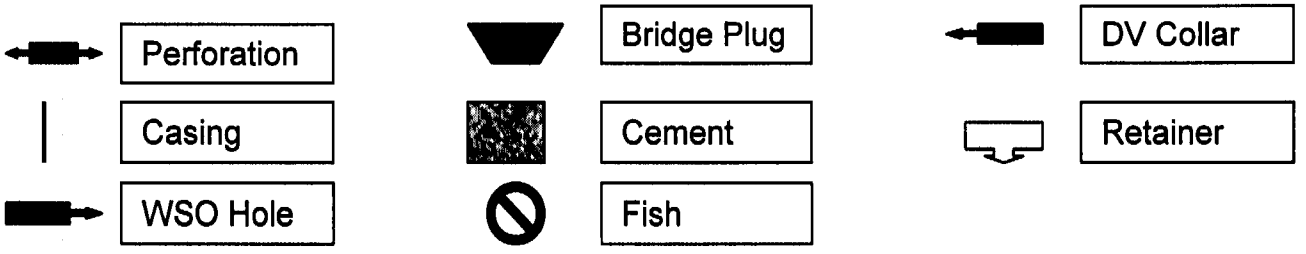
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

"Piacentine" 1-27
API 077-20484

BW – 11/26/2001
Well Class - OG





RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	P-577	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE # 1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., RIO BLANCO (KING ISLAND) Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD = 4715' (Bridge Plug)

2. Complete casing record, including plugs and perforations (present hole)
   8-5/8" 24# K-55 ST&C 8RD casing set at 627'.
   5-1/2" 15.5# K-55 LT&C 8RD casing set at 4900'.

   Perforations: 4750'- 4764' - squeezed 5/9/91.
   4720'- 4724' - squeezed 3/5/97.
   4700-4705' } - squeezed 3/8/01
   4684-4690' }

   4670 - 4678' - open & producing.

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted same

4. Present zone pressure ± 1000 psi ; New zone pressure ± 1200 psi

5. Last produced currently on production (Date) -0- (Oil, B/D) 22 BWPD (Water, B/D) 75 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) ____ (Water, B/D) ____ (Gas, Mcf/D) ____ (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

As per the attached workover procedure.

Div. of Oil & Gas - Dist. 6
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Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address P.O. Box 2788 (Street)
Mammoth Lakes, CA 93546 (City) (State) (Zip)
Telephone Number (760) 934-3356
FAX (760) 934-5637

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name of Owner)
Robert D. Eberts (Name - Signature) 11/10/01 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

Div. of Oil & Gas - Dist. 6
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PIACENTINE #1-27 WELL
WORKOVER PROGRAM
NOVEMBER 10, 2001

WELL INFORMATION

API No: 04-077-20484 FIELD: King Island

ELEVATION: All measurements from KB (13' above GL)
(KB-THF = 11.5')

TD: 4900' PBTD: 4715' (bridge plug)

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 627'

5-1/2" 15.50#, K-55 LT&C csg. from surface to 4900' cemented with 150 sx (TOC @ 4175')

PACKER/TUBING: No packer
2-3/8" 4.7# J-55 8rd EUE tubing to 4587'

EXISTING PERFORATIONS: 4670' - 4678' DIL (open)

BOTTOM HOLE PRESSURE DATA: ± 1300 psi (current zone)

PROPOSED PERFORATIONS: Return to production in current zone with additional perforations 4678'- 4682' DIL

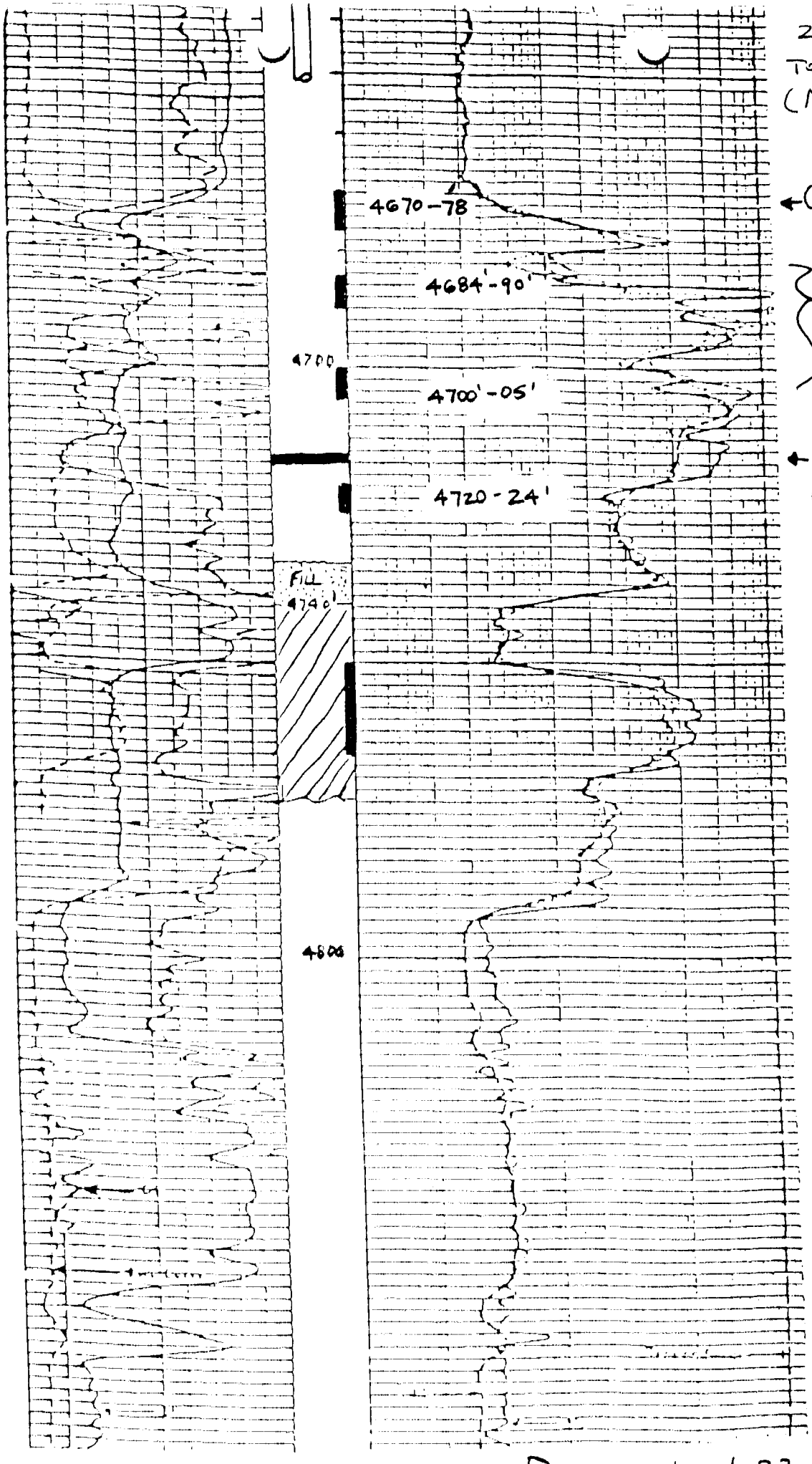
Note: existing perforations 4676'- 4678' DIL to be re-shot

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. R/U Halliburton wireline and test wireline lubricator. RIH with six (6) foot 1-11/16" Deep Star thru tubing perforating gun, configured @ 6 shots/ft & Tri-Phase phasing. Put gun on depth and perforate well from 4676'- 4682' DIL. POOH and R/D Halliburton wireline.

2. Return well to production, initially restricting flow rate to ± 250 mcf/day.



Div. of Oil & Gas - Dist. 6
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NOV 16 2001
Sacramento, California

PIACENTINE 1-27 WELL
SIERRA RESOURCES, INC.

SIERRA RESOURCES
INCORPORATED

FACSIMILE COVER SHEET

DATE: 11/12/01

TO: D.O.G.G.

FROM: DOUG EBERTS

TIME: 9:25 AM/PM

RE: PERMIT TO ADD PERFORATIONS PLACENTINE 1-27 WELL

PAGES: 4 INCLUDING THIS COVER SHEET

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL (760) 934-3356 AND ASK FOR JEANIE.

MESSAGE: ORIGINAL IN THE MAIL TO YOU.

Div. of Oil & Gas - Dist. 6
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NOV 15 2001
Sacramento, California

P.O. BOX 2788 • MAMMOTH LAKES, CA 93546-2788 • (760) 934-3356 • FAX (760) 934-5637

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. "Placentia" 1-27

API No. 037-20484 Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Waterflood	
Abandoned - Oil		Steamflood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole		Air Injection	
Producing - Gas		Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas		LPG Injection	
Gas-Open to Oil Zone		Observation	
Gas Storage		Waterflood Source	

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED _____

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK _____

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (4/93/GSR1/5M)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____ , T. _____ , R. _____ , _____ B. & M.

WORK PERFORMED

Drill _____ Redrill _____ Deepen _____

Plug _____ Alter Casing _____

Waterflood _____ Water Disposal _____

Abandon _____

Other _____

STATUS **DATE**

Producing _____ "E" well Yes ☐ No ☐

Recompleted Producing _____

Waterflood _____

Water Disposal _____

Abandoned _____

Other _____

MAP AND BOOK _____ Engineer _____

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____
(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____
and

File cleared _____ OGD121 _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

2 Hidden Lake Circle
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637
e-mail: sri@qnet.com

Signed: Robert D. Eberts
Robert D. Eberts, President

Date: 5/9/01

Oil & Gas - D...
RECEIVED
MAY 15 2001
Sacramento, California

RECOMPLETION HISTORY

DATE	REMARKS
3/7/01	MIRU rig. R/U on tree. Load well with lease water to kill same. Attempt to remove tubing hanger for two hours without success. Secured well for night.
3/8/01	Opened well - slight vacuum on tubing and casing. N/D tree, N/U and test BOP's. Ran in hole with 2-3/8" tubing to fill @ 4705'. Circulated hole clean to top of CIBP @ 4715'. R/U Halliburton and broke down formation with 650 psi @ 1-1/4 BPM. Mix and pump 25 sacks of neat cement. Equalize cement plug and POOH 350'. Bradenhead squeeze 15 cubic feet ft of cement into perforations 4684-4690' to a squeeze pressure of 2000 psi. Close in well under pressure and secured same for night.
3/10/01	Opened well & bled off pressure. RIH to top of cement @ 4520'. POOH and RIH with 4-3/4" bit and BHA. Rig up power swivel and drill hard cement to 4705'. Circulate clean to 4715'. Secured well for night.
3/11/01	POOH and lay down bit & BHA. RIH with open ended 2-3/8" tubing (drifting same) to 4715'. Land tubing on hanger with tubing tail @ 4587'. N/D BOPE and N/U tree. Rigged up swab line and swabbed fluid level down to 2000'. R/D and release rig. Secured well for night.
3/28/01	Opened well - dead. R/U Halliburton wireline and perforated 4670 - 4676' DIL with 1-11/16" zero degree phased Deep Star gun @ 6 SPF. Well would not unload. Secured well for night to wait on swabbing unit.
4/5/01	Opened well - 220 psi on tubing and casing. Rigged up swab unit, swabbed well in and returned well to production in new perforations. Zone very tight with limited flow potential.
4/11/01	R/U Halliburton wireline and re-perforated zone from 4670 to 4678' DIL with 1-11/16" tri-phased Deep Star gun @ 6 SPF. Returned well to production.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 601-084

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
00 (new pool code)
00 (old pool code)

Mr. Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
P.O. Box 2788
Mammoth Lakes, CA 93546-2788

Sacramento, California
February 27, 2001

Your _____ proposal to Rework well "Piacentine" 1-27
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B.&M.
King Island Gas field, any area Mokelumne pool
San Joaquin County, dated 02/16/2001, received 02/26/2001 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 3M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 3M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. **THIS DIVISION IS NOTIFIED:**
   a. In the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks, they shall be promptly reported to this district office.
   b. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   c. To inspect the installed blowout prevention equipment prior to commencing operations.

Blanket Bond
BW/jc
Enc(2)

Engineer Bill Winkler
Phone (916) 322-1110

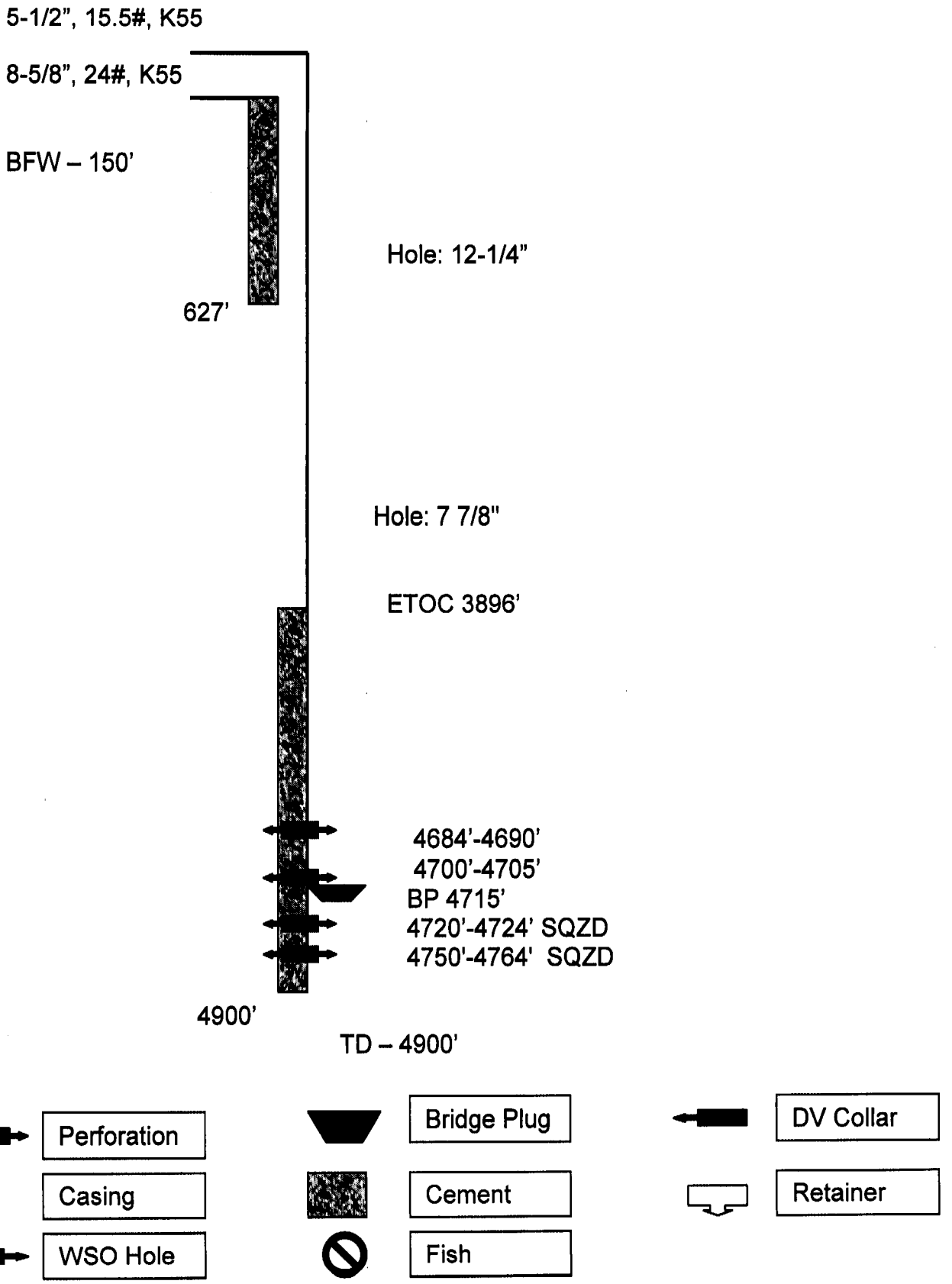
WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor
By Robert A. Reid
Robert A. Reid, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

"Piacentine" 1-27
API 077-20484

Spud Date:
BW – 02/27/2001
Well Class - OG



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FEB 26 2001

Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD114	OGD121
BB	P-084	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention

to rework well PIACENTINE # 1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., ~~RIO BLANCO~~ Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD = 4715' (Bridge Plug)

2. Complete casing record, including plugs and perforations (present hole)
   8-5/8" 24# K-55 ST&C 8RD casing set at 627'.
   5-1/2" 15.5# K-55 LT&C 8RD casing set at 4900'.

   Perforations: 4750'- 4764' - squeezed 5/9/91.
   4720'- 4724' - squeezed 3/5/97.

   4700'- 4705' open & producing.
   & 4684 - 4690'

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted same

4. Present zone pressure ± 1200 psi ; New zone pressure ± 1200 psi

5. Last produced currently on production (Date) -0- (Oil, B/D) 15 BWPD (Water, B/D) 50 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) ____ (Water, B/D) ____ (Gas, Mcf/D) ____ (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

AS PER ATTACHED WORKOVER PROCEDURE.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address P.O. BOX 2788 (Street)
MAMMOTH LAKES, CA 93546 (City) (State) (Zip)
Telephone Number (760) 934-3356
FAX (") 934-5637

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name Printed)
Robert D. Eberts (Name - Signature) 2/16/01 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

Div. of Oil & Gas - Dist. 6
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FEB 26 2001

Sacramento, California

PIACENTINE #1-27 WELL
REVISED WORKOVER PROGRAM
FEBRUARY 16, 2001

WELL INFORMATION

API No: 04-077-20484 FIELD: King Island

ELEVATION: All measurements from KB (13′ above GL)
(KB-THF = 11.5′)

TD: 4900′ PBTD: 4715′ (bridge plug)

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 627′

5-1/2" 15.50#, K-55 LT&C csg. from surface to 4900′ cemented with 150 sx (TOC @ 4175′)

PACKER/TUBING: No packer
2-3/8" 4.7# J-55 8rd EUE tubing to 4650′

EXISTING PERFORATIONS: 4684′- 4690′ & 4700′- 4705′ DIL (open)

BOTTOM HOLE PRESSURE DATA: ± 1100 psi (current zone)

PROPOSED PERFORATIONS: Return to production in current zone
(4684′- 4690′ upper perfs only)

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. MIRU rig. R/U on tree. Circulate well with lease water and kill same. N/D tree and N/U BOP's. Note: Send in tree to Cameron's Woodland shop to service same.

2. POOH slowly, keeping hole full and stand back tubing.

PIACENTINE #1-27 WELL
WORKOVER PROGRAM
FEBRUARY 16, 2001

Div. of Oil & Gas - Dist. 6
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Sacramento, California

3. Pick up additional tubing and RIH open ended with tubing string. Reverse circulate clean to top of bridge plug @ 4715'. R/U cementers and test lines and manifold to 3000 psi. Spot 200" cement plug and pull tubing to ± 4400'. Reverse circulate clean above cement plug.

4. Bradenhead squeeze perforations 4684'- 4690' & 4700'- 4705' to 1000 psi over initial injection pressure (do not exceed 2500 psi). POOH with tubing string and secure well for night.

5. Trip in hole with bit and BHA on tubing string. Tag cement and drill out same to top of bridge plug @ 4715'. Circulate clean and test perforations to 1000 psi. Re-squeeze if necessary.

6. Circulate clean, POOH standing back tubing string and L/D BHA.

7. Trip in hole open ended tubing to 4650'.

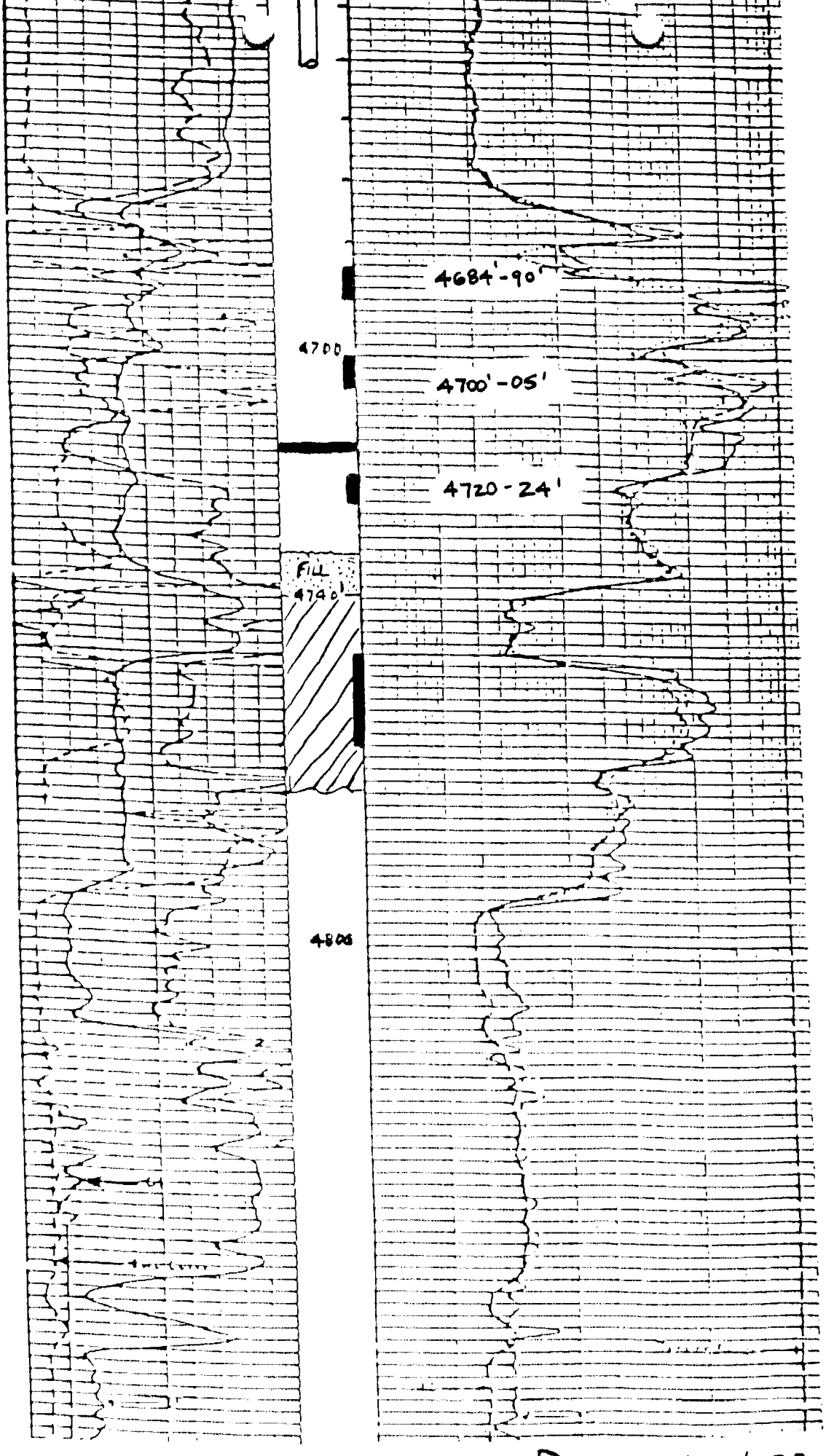
8. N/D BOP's, N/U and test tree. Swab fluid down to 1500'.

9. R/U Halliburton wireline and test wireline lubricator. Run TMDL pulsed neutron log from 4715'- 4600' to determine residual gas saturations through productive interval.

10. GIH with 2-1/8" Deep Star thru tubing perforating gun, 6 shots/ft, Tri-Phase phasing. Perforate 4684'- 4690' DIL. Swab well in if necessary.

    <u>Note</u>: Perforations could change depending on results of cased hole neutron log.

11. Unload and test well as needed. Obtain gas sample.



Div. of Oil & Gas - Dist. 6
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FEB 26 2001
Sacramento, California

PIACENTINE 1-27 WELL
SIERRA RESOURCES, INC.

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	11/2/98
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Waterflood	
Abandoned - Oil		Steamflood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole		Air Injection	
Producing - Gas	X	Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas		LPG Injection	
Gas-Open to Oil Zone		Observation	
Gas Storage		Waterflood Source	

DATE 5/18/98 "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 ✓ 9V
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (4/93/GSR1/5M)

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

WORK PERFORMED	STATUS	DATE
Drill _____ Redrill _____ Deepen _____	Producing _____	"E" well Yes ☐ No ☐
Plug _____ Alter Casing _____	Recompleted Producing _____	
Waterflood _____ Water Disposal _____	Waterflood _____	
Abandon _____	Water Disposal _____	
Other _____	Abandoned _____	
	Other _____	
	MAP AND BOOK _____ Engineer _____	

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____
(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____
and

File cleared _____ OGD121 _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

450 Fairway Drive #705
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637

Signed: Robert D. Eberts
Robert D. Eberts, President

Date: 6/26/98

RECOMPLETION HISTORY

DATE	REMARKS
5/18/98	R/U Halliburton wireline and test wireline lubricator. GIH with 1-11/16" Deep Star thru tubing perforating gun, 4 shots/ft, 90 degree phasing. Perforate 4684'- 4690' DIL. **Unload and test well @ ± 500 mcf/day with 1120 psi FTP and 1190 psi SITP.** Obtain gas sample. Rig down and release Halliburton wireline unit.

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 02 1998
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 697-333

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
10 (new pool code)
10 (old pool Code)

Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
Truxtun Avenue, Suite 250
Bakersfield, CA 93309

Sacramento, California
August 26, 1997

Your proposal to rework well "Piacentine" 1-27, A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D.B.& M., King Island Gas field, Any area, Mokelumne River pool, San Joaquin County, dated 8/18/97, received 8/21/97 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 2M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 2 M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To inspect the installed blowout prevention equipment prior to commencing operations.

Engineer Robert S. Habel

Phone (916) 322-1110

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

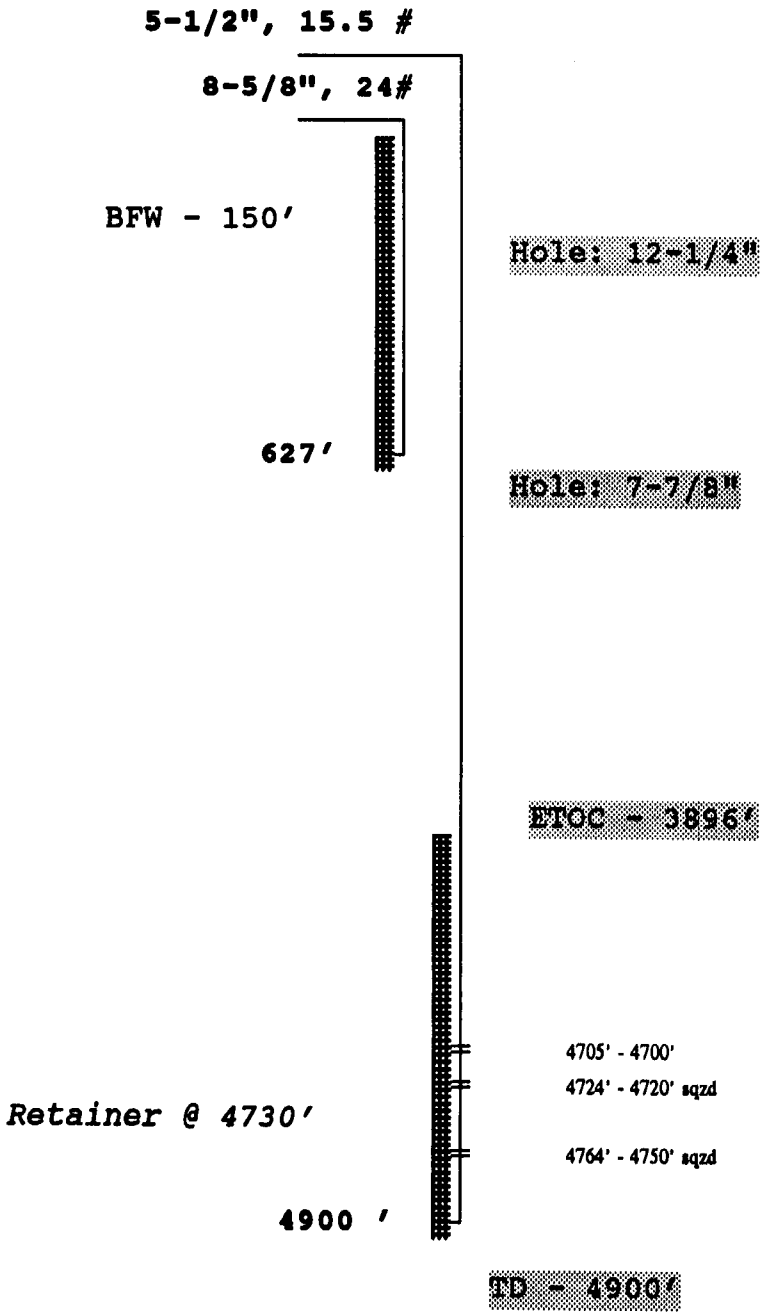
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (2/95/GSR1/5M)

"Piacentine" 1-27
077-20484

Spud Date:7/4/86
RSH - August 26, 1997
Well Class - Development



KEY

|	Casing	▩	Cement
┼	WSO Hole	⊕	Fish
╪	Perf.	■	Bridge plug/Retainer

Div. of Oil & Gas - Dist. 6
RECEIVED
AUG 21 1997
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention

to rework well PIACENTINE # 1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., RIO BLANCO Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD = 4715' (Bridge Plug)

2. Complete casing record, including plugs and perforations (present hole)
   8-5/8" 24# K-55 ST&C 8RD casing set at 627'.
   5-1/2" 15.5# K-55 LT&C 8RD casing set at 4900'.

   Perforations: 4750'- 4764' - squeezed 5/9/91.
   4720'- 4724' - squeezed 3/5/97.

   4700'- 4705' open & producing.

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted same

4. Present zone pressure ± 1100 psi ; New zone pressure ± 1200 psi

5. Last produced currently on production (Date) -0- (Oil, B/D) 5 BWPD (Water, B/D) 300 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) ____ (Water, B/D) ____ (Gas, Mcf/D) ____ (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

1) R/U Electric wireline and add additional perforations as follows:
   4684' - 4690' DIL.

2) R/D wireline and return well to production.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 5601 Truxtun Ave. Ste. 250 (Street)
Bakersfield, CA 93309 (City) (State) (Zip)
Telephone Number (805) 631-8378
FAX (805) 631-9761

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name - Printed)
Robert D. Eberts (Name - Signature) 8/18/97 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. [illegible] Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE	STATUS		STATUS	
Well Summary (Form OG100)	REWORK 5/5	Producing - Oil		Water Disposal	
History (Form OG103)		Idle - Oil		Waterflood	
Core Record (Form OG101)		Abandoned - Oil		Steamflood	
Directional Survey		Drilling - Idle		Fire Flood	
Sidewall Samples		Abandoned - Dry Hole		Air Injection	
Other		Producing - Gas	X	Gas Injection	
Date final records received		Idle - Gas		CO_2 Injection	
Electric logs:		Abandoned - Gas		LPG Injection	
		Gas-Open to Oil Zone		Observation	
		Gas Storage		Waterflood Source	

DATE RECOMPLETED 3/3/97 "E" well Yes ☐ No ☐

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 ✓
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____ , T. _____ , R. _____ , _____ B. & M.

WORK PERFORMED

Drill _____ Redrill _____ Deepen _____

Plug _____ Alter Casing _____

Waterflood _____ Water Disposal _____

Abandon _____

Other _____

STATUS **DATE**

Producing _____ "E" well Yes ☐ No ☐

Recompleted Producing _____

Waterflood _____

Water Disposal _____

Abandoned _____

Other _____

MAP AND BOOK _____ Engineer _____

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____
(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____
and

File cleared _____ OGD121 _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

2 Hidden Lake Circle
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637
e-mail: sri@qnet.com

Signed: Robert D. Eberts
Robert D. Eberts, President

Date: 2/28/01

RECOMPLETION HISTORY

DATE	REMARKS
8/9/97	MIRU rig. R/U on tree. Mix HEC pill and load well with lease water to kill same. Lubricated HEC pill to perforations to minimize fluid loss to producing zone. Filled tubing annulus as required and bled off gas. Secured well for night.
8/10/97	Opened well - dead. N/D tree, N/U and test BOP's. Released packer and filled hole as required. RIH to 4736' (tag depth). POOH slowly, keeping hole full and layed down 2-7/8" tubing and packer. R/U Halliburton wireline. Made gauge ring run to 4718', ran and set bridge plug @ 4715'. R/D Halliburton wireline. RIH and landed 2-3/8" production tubing with muleshoe tail @ 4650'. N/D BOP's, N/U and test tree. Note: Installed soap pump on 5-1/2" casing. Secured well for night.
8/11/97	Opened well - dead. Rigged up swab line, swabbed well in and returned well to production in current perforations (4700 - 4705' DIL).

Received Late

Div. of Oil & Gas - Dist. 6
RECEIVED
FEB 2 2 2001
Sacramento, California

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

5601 Truxtun Avenue
Suite 250
Bakersfield, CA 93309
(805) 631-8378
FAX (805) 631-9761

Signed: Robert D. Eberts
Robert D. Eberts, President

Date: 4/30/97

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 0 5 1997
Sacramento, California

RECOMPLETION HISTORY

DATE	REMARKS
2/26/97	MIRU Oil Well Service rig. R/U on tree. Pump in well with lease water and attempt to kill same. Pressured up to 2000 psi with 30 barrels down tubing. Flowed back 25 barrels and shut in well with 640 psi SITP. Mix 72 lb/bbl salt water and kill well with same. N/D Tree and N/U BOP's with 2-7/8" rams and test same. Released packer and circulate well. POOH, laid down packer and stood back tubing. RIH with open ended tubing to 4727' and secured well for night.
2/27/97	Opened well - no pressure. Pumped 40 bbls lease water with no returns. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement plug and equalize plug with lease water - CIP @ 10:50 am. POOH ten stands and reverse circulate clean. Braden head squeeze to 2000 psi, shut in well under pressure and secured well for night.
2/28/97	Opened well - 650 psi SITP. Bled off same and RIH with tubing, tagging cement @ 4573'. POOH and made up drilling BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4573'. R/U power swivel and drill out soft cement from 4573' to 4675'. Circulate clean and secured well for night to wait on cement.
3/03/97	Resumed drilling on firm cement from 4675' to 4730'. Pressure up to 700 psi - broke down taking 2-1/2 bbls/minute @ 500 psi. POOH and stand back BHA. RIH with open ended tubing to 4730'. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement w/ 2.5% CaCl and equalize plug with lease water - CIP @ 1:30 pm. POOH ten stands and reverse circulate clean. Braden head squeeze to 2500 psi, shut in well under pressure and secured well for night to allow cement to harden.

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 0 5 1997
Sacramento, California

3/04/97 Opened well - 1500 psi SITP. Bled off same and RIH with tubing, tagging cement @ 4556'. POOH and made up drilling BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4556'. R/U power swivel and drill out firm cement from 4556' to EZSV retainer @ 4730'. Continue drilling out retainer , cement and junk to 4758', began torquing up badly. POOH and inspect bit. RIH with same and resumed drilling, changing weight and RPM - unable to make progress. Pressure up to 900 psi - well taking fluid @ 2 bbls/minute. Secured well for night.

3/05/97 POOH and stand back BHA. RIH with open ended tubing to 4754'. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement w/ 2.5% CaCl and equalize plug with lease water - CIP @ 11:30 am. POOH ten stands and reverse circulate clean. Braden head squeeze to 2000 psi, shut in well under pressure and secured well for night to allow cement to harden.

3/06/97 Opened well - 50 psi SITP. Bled off same and RIH with tubing, tagging cement @ 4551'. POOH and made up drilling BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4551'. R/U power swivel and drill out firm cement from 4551' to 4740'. Circulate clean and pressure test squeeze to 1100 psi, test held. Made up casing scraper and round trip to 4740'. Made up 5-1/2" x 2-7/8" "Big Bore" R-3 packer and TIH with production setting as before. Secured well for night.

3/07/97 Continue TIH with 5-1/2" x 2-7/8" "Big Bore" R-3 packer and production setting. Set production packer @ 4585' w/ 12,000# in compression. Test packer to 1000 psi on casing and land tubing. N/D BOP's, N/U and test tree. Swab fluid down to 1500'. Secured well for night.

3/08/97 R/U Halliburton wireline and test wireline lubricator. Attempt to Run TMDL log - hit obstruction @ 4733'. Unable to clear - forced to trip and reset production setting to clear obstruction. R/U Halliburton wireline and test wireline lubricator. Ran TMDL pulsed neutron log from 4723'- 4490' to determine residual gas saturations. GIH with 2-1/8" Deep Star thru tubing perforating gun, 6 shots/ft, Tri-Phase phasing. Perforate 4700'- 4705' DIL. **Unload and test well @ ± 600 mcf/day with 1120 psi FTP and 1180 psi SITP.** Obtain gas sample. Rig down and release rig.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

PERMIT TO CONDUCT WELL OPERATIONS

No. P 696-354
351 (field code)
00 (area code)
10 (new pool code)
10 (old pool Code)

Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
5601 Truxtun Ave., Suite 250
Bakersfield, CA 93309

Sacramento, California
November 20, 1996

Your proposal to rework well "Piacentine" 1-27, A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D.B.& M., King Island Gas field, Any area, Mokelumne pool, San Joaquin County, dated 11/12/96, received 11/18/96 has examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 2M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 2 M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.

Blanket Bond
RSH:sr

Engineer Robert S. Habel

Phone (916) 322-1110

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

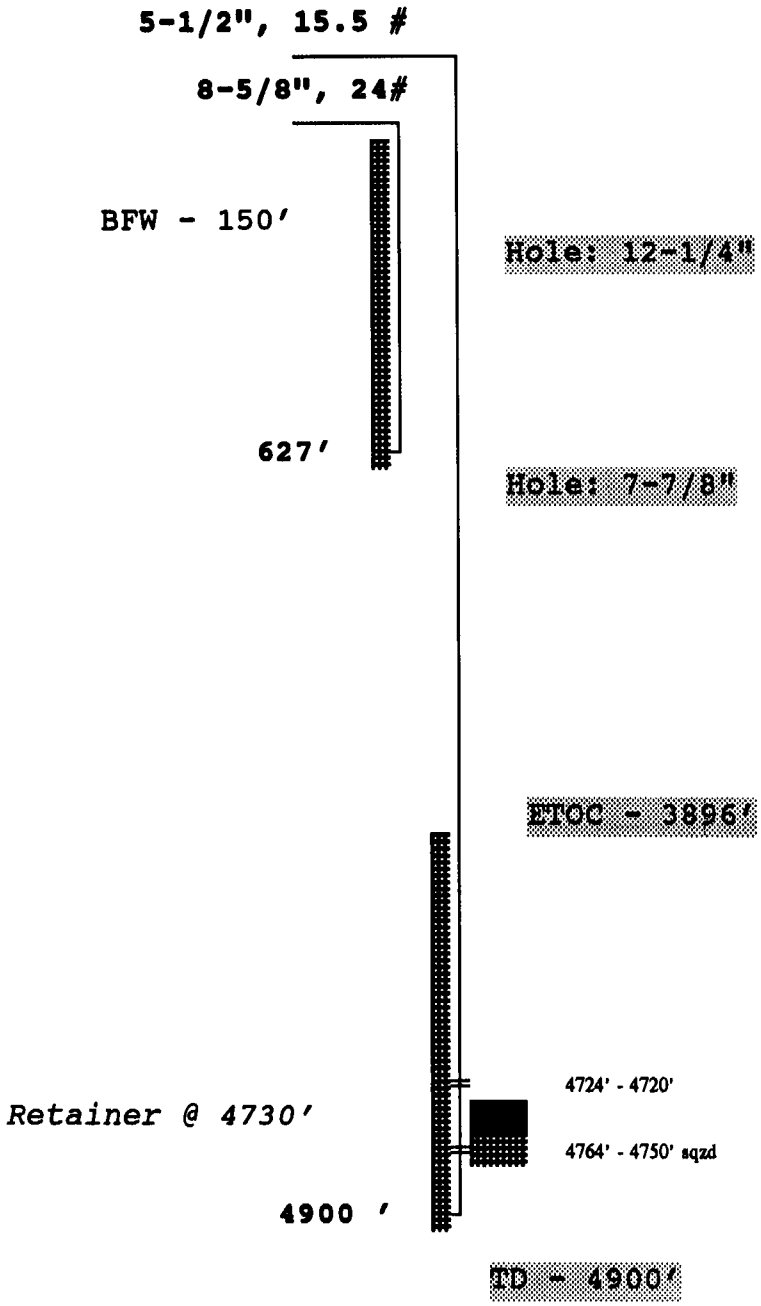
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (2/95/GSR1/5M)

"Piacentine" 1-27
077-20484

Spud Date:7/4/86
RSH - November 20, 1996
Well Class - Development



KEY

|	Casing		Cement
+	WSO Hole		Fish
‡	Perf.		Bridge plug/Retainer

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

RECEIVED
NOV 18 1996
Sacramento, California

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE #1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., RIO BLANCO Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD 4730'

2. Complete casing record, including plugs and perforations (present hole)

   8 5/8" 24# K-55 ST&C 8Rd. casing set at 627'.
   5 1/2" 15.5 # K-55 LT&C 8Rd casing set at 4900'.

   Perforations: 4750'-4764' - squeezed 5/9/91.
   4720'-4724' - open

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure ± 1500psi (est) ; New zone pressure ± 2000 psi (est)

5. Last produced currently on production (Date) -0- (Oil, B/D) 50 BWPD (Water, B/D) 300 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) ____ (Water, B/D) ____ (Gas, Mcf/D) ____ (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:
Recomplete to shallower zone within Mokelumne Sand. Present interval depleting.
See detailed workover procedure attached.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 5601 Truxtun Ave. Ste 250 (Street)
Bakersfield CA 93309 (City) (State) (Zip)
Telephone Number (805) 631-8378
FAX (805) 631-9761

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name-Printed)
Robert D. Eberts (Name-Signature) 11/12/96 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 18 1996
Sacramento, California

PIACENTINE #1-27 WELL
WORKOVER PROGRAM
NOVEMBER 12, 1996

WELL INFORMATION

API No: 04-077-20484 FIELD: King Island

ELEVATION: All measurements from KB (13' above GL)
(KB-THF = 11.5')

TD: 4900' PBTD: 4730'

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 627'

5-1/2" 15.50#, K-55 LT&C csg. from surface to 4900' cemented with 150 sx (TOC @ 4175')

EXISTING PERFORATIONS: 4720'- 4724' (open)
4750'- 4764' (squeezed)

BOTTOM HOLE PRESSURE DATA: ± 1500 psi (current zone)
± 2000 psi (new zone)

PROPOSED PERFORATIONS: 4700'- 4710' EL (4701'- 4711' DN)

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. MIRU rig. R/U on tree. Pump in well with lease water and kill same. Fill tubing annulus as required. N/D tree and N/U BOP's.

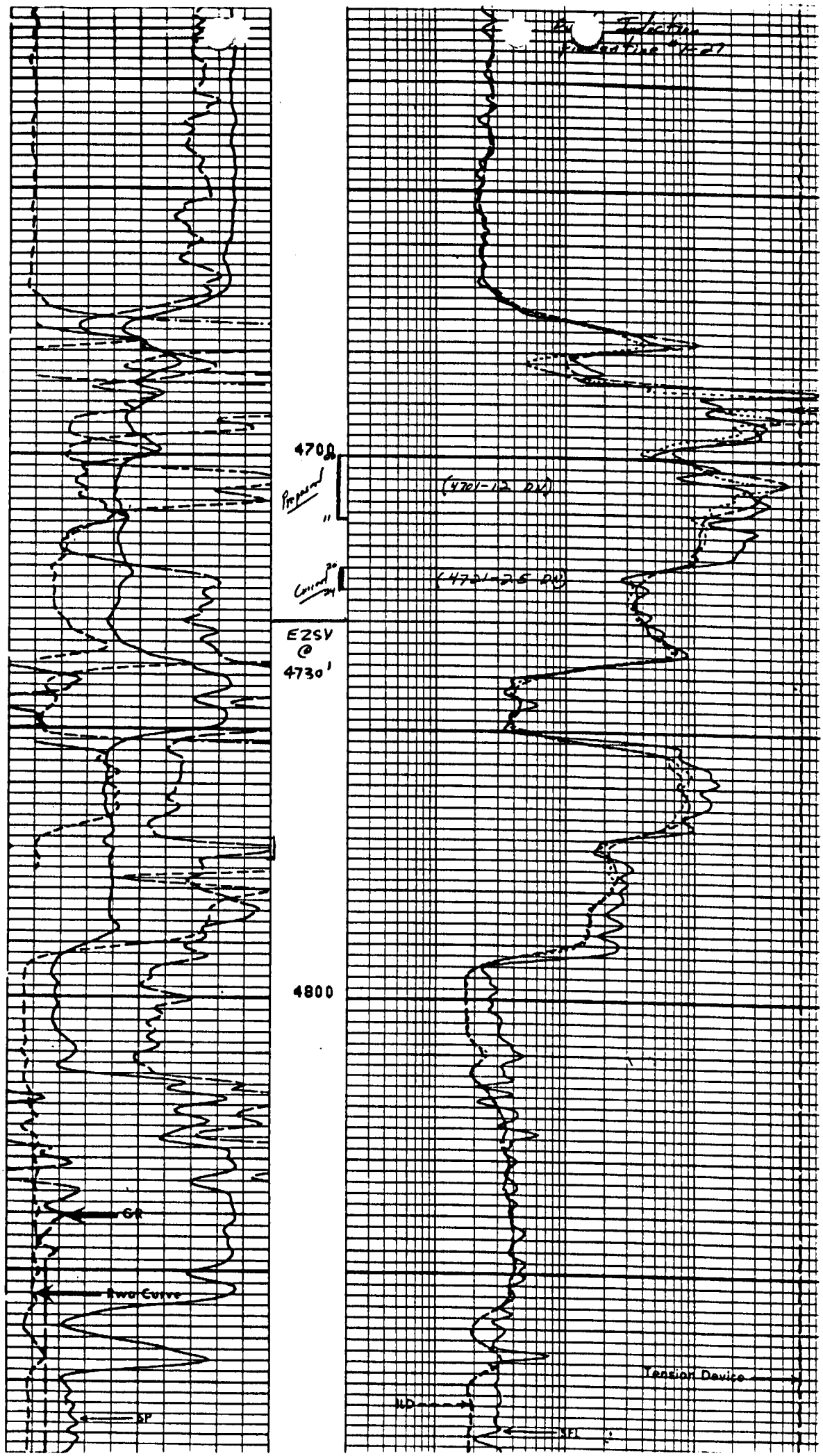
2. Release packer and circulate out. POOH slowly, keeping hole full.

3. R/U wireline. Make gauge ring/junk basket run to 4720'. Set wireline CIBP @ 4715'. POOH with wireline and test casing to 1000 psi.

4. Trip in hole with redressed packer and production setting as before. Set production packer @ ± 4600'. Test packer to 1000 psi on casing.

5. N/D BOP's, N/U and test tree. Swab fluid down to 2000'. R/U and test wireline lubricator. GIH with 1-11/16" thru tubing perforating gun. Perforate 4700'-10' EL (4701'-4711' DN) w/ 4-SPF.

6. Unload and test well as needed. Obtain gas sample. R/D and release rig.


4700
Prepared
(4701-12 DW)
Cutting
(4701-26 DW)
EZSV
@
4730'
4800
GR
Two Curve
SP
Tension Device
HD
SFL

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF PROPERTY AND WELL TRANSFER

Field or county	District
SAN JOAQUIN COUNTY	6
Former owner	**Date**
QUINTANA PETROLEUM CORPORATION	12/27/94

Name and location of well(s)

"MORESCO ET AL UNIT A" #1	28/3N/5E	007-20469
"PIACENTINE" 1-27	27/3N/5E	077-20484

Description of the land upon which the well(s) is (are) located

Date of transfer, sale, assignment, conveyance, or exchange	New owner	Type of organization
12/1/94	SIERRA RESOURCES, INC.	CORP.
	Address: 5601 Truxtun Ave. Suite 250 Bakersfield, CA 93309	Telephone No. (805) 631-8378

Reported by
K. Briggs - QUINTANA

Confirmed by
R. Eberts - SIERRA

New operator new status (status abbreviation)	Request designation of agent
PA	
Old operator new status (status abbreviation)	**Remarks**
PA	

Deputy Supervisor	Signature
ROBERT A. REID	Robert A. Reid 12/28/94

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
Ab – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book		
Form ODG148			Notice to be cancelled		
New well cards			Bond status		
Well records			EDP files		
Electric logs					
Production reports					

OGD156 (2/85/DWRR/2M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF CORRECTION OR CANCELLATION

Sacramento California

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Dr., Suite 133
Bakersfield, CA 93309

January 27, 1994

In accordance with your request

the following change pertaining to your well "Piacentine" 1-27 (Well designation),
King Island Gas field, San Joaquin County,
Sec. 27, T. 3N, R. 5E, M.D. B. & M., is being made in our records:

☐ The corrected location is

☐ The corrected elevation is

☐ Report No. , dated , has been corrected as follows:

☒ Your notice to rework (Drill, abandon, etc.) dated 8/13/92, and our report No. P 692-295, issued in answer thereto, are hereby cancelled inasmuch as the work will not be done. If you have an individual bond on file covering this notice, it will be returned. No request for such return is necessary.

☐ Other:

William F. Guerard, Jr.
State Oil and Gas Supervisor

By Robert A. Reid
Deputy Supervisor

ROBERT A. REID

OG165 (2/88/DWRR/3M)

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
District 6, (916) 322-1110

No. P 692-295

351
(field code)
00
(area code)
10
(new pool code)
10
(old pool code)

PERMIT TO CONDUCT WELL OPERATIONS

James R. Weddle, Agent
QUINTANA PETROLEUM CORPORATION
1400 Easton Dr., Suite 411
Bakersfield, CA 93309

Sacramento, California
August 25, 1992

Your proposal to rework well "Piacentine" 1-27 API No. 077-20484 Section 27, T. 3N, R. 5E, M.D. B. & M., King Island Gas field, any area, Mokelumne pool, San Joaquin County, dated 8-13-92, received 8-25-92 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 5 1/2" casing and maitained in operating condition at all times. See Manual M07 and attached sheet.
2. Wire line operations are conducted through at least a 3M lubricator.
3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water is indicated, remedial action will be ordered.

THIS DIVISION IS NOTIFIED:

a. Before deviating from the proposed program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.

Rec'd / Co. Rep. 11/6/92
Work has not been done as yet because the presently open interval increased to about ≈ 500 Mcf/d. When this interval becomes non-commercial, the interval covered by this notice will be perforated.

Blanket Bond
RSH:jhs

K.P. Henderson, Acting Chief

By Robert A. Reid
Deputy Supervisor
Robert A. Reid

A copy of this report and the proposal must be posted at the well site prior to commencing operations. Records for work done under this permit are due within 60 days after completion, suspension, or abandonment.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

Div. of Oil & Gas - Dist.
RECEIVED

OG 107 (8/79)

DIVISION OF OIL AND GAS

AUG 25 1992

Notice of Intention to Rework Well

Sacramento, California

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
Bb	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE #1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., Rio Blanco Field, San Joaquin County.

The present condition of the well is as follows:

1. Total depth 4900'

2. Complete casing record, including plugs and perforations

   8 5/8" 24# K-55 ST&C 8Rd casing set at 627'.
   5 1/2" 1.55# K-55 LT&C 8Rd casing set at 4900'.

   Perforations: 4750'-4764' - squeezed 5/9/91.
   4720'-4730' - open

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure unknown (depleting) ; New zone pressure ±2000 psi (est)

5. Last produced currently on production (Date) | -0- (Oil, B/D) | -0- (Water, B/D) | 266 mcfd (Gas, Mcf/D)

   (or)

   Last injected _____ (Date) | _____ (Water, B/D) | _____ (Gas, Mcf/D) | _____ (Surface pressure, psig)

The proposed work is as follows:

Recomplete to shallower zone within Mokelumne Sand. Present interval depleting. See detailed workover procedure attached.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 1325 So. Colorado Blvd., Ste. 411 (Street)
Denver (City) Colorado (State) 80222 (Zip)

Telephone Number (303)692-9559

QUINTANA PETROLEUM CORPORATION (Name of Operator)

By J. M. Snider (Print Name)

J M Snider (Signature) 8/13/92 (Date)

WORKOVER RECOMMENDATION

WELL NAME: PIACENTINE NO. 1-27 AFE NO: 52008

DATE: August 11, 1992 PRIORITY: _____

DISTRICT: Western FIELD: King Island

ELEVATION: 11.5' KB-THF TD: 4900' PBTD: 4730'

CASING SIZE & SETTING DEPTH: 5-1/2" 15.50#, K-55, LT&C cemented with 150 sx TOC @ 4175'

PROPOSED PERFS: 4701'-12' DN 4-SPF

PRODUCING FORMATION: Mokelumne (Perfs 4720'-24')

BOTTOM HOLE PRESSURE DATA: ± 2050 psi (estimated)

PACKER/ANCHOR: Baker "R-3" packer @ 4611'

TUBING SIZE & DEPTH: 2-7/8", 6.5#, J-55, EUE, 8rd at 4611'

PUMP: N/A

RODS: N/A

WELL HEAD: 11" 3M X 7-1/16" 3M

LAST PRODUCTION TEST: _____ BOPD _____ MCFPD _____ " CHOKE

REASON FOR WORKOVER: Recomplete to shallower zone within the Mokelumne Sand. Present interval depleting.

PREPARED BY: T.M. Stone RESERVOIR DEPT.: _____

PRODUCTION DEPT.: _____ APPROVED BY: _____

WORKOVER PROCEDURE

1. MIRU rig. R/U on tree. PI well with 9.4 ppg brine water and kill well. Fill tubing annulus as required. N/D tree, N/U BOP's.

2. Release packer. Circulate out. POOH slow – keep hole full.

3. R/U wireline. Make gauge ring-junk basket run to ± 4720'. Set wireline CIBP at 4715'. POOH with wireline. Test casing to 1000 psi.

4. GIH with production setting as before. Set production packer at ± 4600'. Test packer to 1000 psi on casing.

5. N/D BOP's. N/U and test tree. Swab fluid down to 2000'. R/U and test lubricator. GIH with 1-11/16" thru tubing perforating gun. Perforate 4701'-12' DN 4-SPF.

6. Unload and test well as needed. Obtain gas sample. Release rig.

DIVISION OF OIL AND GAS
CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. 077-20484 Sec. _____, T. _____, R. _____, _____ B.&M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	RENORL 8/28/91
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Waterflood	___
Abandoned - Oil	___	Steamflood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	X	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Gas Storage	___	Waterflood Source	___

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change ____ (F-OGD165) _____
2. Elevation change ____ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (5/89/GSR1/5M)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No._____

API No._____ Sec._____, T._____, R._____, _____B.&M.

WORK PERFORMED	STATUS	DATE
Drill_____ Redrill_____ Deepen_____	Producing_____ "E" well Yes☐ No☐	
Plug_____ Alter Casing_____	Recompleted Producing_____	
Waterflood _____ Water Disposal_____	Waterflood _____	
Abandon_____	Water Disposal_____	
Other_____	Abandoned_____	
	Other_____	
	MAP AND BOOK_____ Engineer_____	

RECORDS FILED AND DATE Clerk_____

Summary_____

Log and Core_____

History_____

E-log_____

_____

Directional Survey_____

Other_____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location_____ Notice states_____

_____

_____

_____

_____

Elevation_____ Notice states_____

_____

_____

_____

Production Reports_____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection_____

Data Needed_____

Request Records_____ OGD170____

Correct records_____ OGD165____
(Specify)

EDP_____(OGD42A-1, 2) ____

CARDS_____

BOND_____

Hold_____ Reason_____

Release____ Date Eligible_____ OGD150____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection_____ Engineer____

FINAL LETTER_____ OG159____
and
File cleared _____ OGD121____

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
MAY 28 1991
WOODLAND, CALIFORNIA

History of Oil or Gas Well

Operator Quintana Petroleum Corporation Field ..... County San Joaquin
Well PIACENTINE #1-27, Sec. 27, T 3N, R 5E, MD B. & M.
A.P.I. No. 04-077-20484 Name J. M. Snider (Person submitting report) Title Production Tech. (President, Secretary or Agent)
Date May 21, 1991

Signature J M Snider

1325 So. Colorado Blvd., Suite 411, Denver, CO 80222 (Address) (303)692-9559 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date		
		Workover - AFE #51006 Purpose: Recomplete to shallower zone within Mokelumne Sand.
5/7/91	4856'	Day 1. RD flowline and equipment. Prep to MI WO rig. DC $1179 CTD $1179
5/8/91	4856'	Day 2. MW 9.4 MI RU Snow Oilfield Service Rig #8. RU lines. PI and killed well w/40 bbls 9.4 ppg brine water. Well on vacuum. ND tree. NU BOP's. Tested BOP's. Release packer and POOH. RU wireline. Ran gauge ring and junk basket to 4740'. WIH w/EZSV and set at 4730'. Closed BR and tested casing and retainer to 1000 psi. SWIFN. DC $6523 CTD $7702
5/9/91	4730'	Day 3. MW 8.8 TIH w/stinger. Test retainer on casing to 1000 psi. Mixed 50 sxs Class "G" cement at 15.8 ppg. Squeezed perforations 4750'-4764' at final rate of 1/2 bpm 2600 psi, 1500 psi static. Reversed out 5 sxs cement. POOH. GIH w/production tubing. Set packer at 4611'. Tested pkr to 1000 psi. ND BOP's. NU tree. SWIFN. DC $7906 CTD $15,608
5/10/91	4730'	Swbd well to 1200'. Perforated 4720'-4724' with 4 jspf. RU swab. Tagged FL at 1200'. Swbd to 2500', well started unloading. Cleaned up well. Final flow on 12/64" ck 800 MCFD, FTP 1050 psi. No water. SI well. 30 min SIP 1100 psi. RD and release rig. DC $6785 CTD $22,393 FINAL REPORT
5/14/91		Well returned to production 9:00 a.m.

Piancentine #1-27 2 7/8" Tubing Detail May 8, 1991		
1	2 7/8" MULESHOE	.88
1	5 1/2" BAKER MODEL R DOUBLE GRIP PKR	7.18
1 JT	2 7/8" 6.5# J-55 EUE TUBING	31.14
1	2 7/8" F NIPPLE (I.D. 2.31")	.97
149 JTS	2 7/8" 6.5# J-55 EUE TUBING	4,557.42
1	2 7/8" TUBING HANGER	.80
	TOTAL TUBING AND EQUIPMENT	4,598.39
	DISTANCE RKB TO HANGER	+13.00
	EFFECTIVE TUBING SETTING	4,611.39

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 691-121

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
10 (new pool code)
10 (old pool code)

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Woodland, California
April 1, 1991

Your _____ proposal to rework well "Piacentine" 1-27, A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B. & M., King Island Gas field, Any area, Mokelumne River pool, San Joaquin County, dated 3/25/91, received 3/29/91 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Wire line operations are conducted through at least a 3M lubricator.

Blanket Bond
LFC/km
cc: Co. Prudential Plaza

Engineer _____

Phone _____

M. G. MEFFERD, State Oil and Gas Supervisor

By Robert A. Reid
Acting Deputy Supervisor
ROBERT A. REID

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (3/90/GSR1/5M)

OG107 (8/79)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

RECEIVED
MAR 29 1991
WOODLAND, CALIFORNIA

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD114	OGD121
BB	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention

to rework well PIACENTINE #1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., Rio Blanco Field, San Joaquin County.

The present condition of the well is as follows:

1. Total depth 4900'

2. Complete casing record, including plugs and perforations
   8 5/8" 24# K-55 STUC 8Rd casing set at 627'.
   5 1/2" 15.5# K-55 LT&C 8Rd casing set at 4900'.
   Perforations: 4750'-4764'

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure unknown (depleting) ; New zone pressure ±2060 psi (est)

5. Last produced 3/23/91 (Date) -0- (Oil, B/D) 7.5 (Water, B/D) 178 (Gas, Mcf/D)

   (or)

   Last injected _____ (Date) _____ (Water, B/D) _____ (Gas, Mcf/D) _____ (Surface pressure, psig)

The proposed work is as follows:

Recomplete to shallower zone within Mokelumne Sand. Present interval depleting. See detailed workover procedure attached.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 1362 So. Colorado Blvd., Suite 411 (Street)
Denver (City) Colorado (State) 80222 (Zip)
Telephone Number (303)692-9559

QUINTANA PETROLEUM CORPORATION (Name of Operator)
By J. M. Snider (Print Name)
JMSnider (Signature) 3/25/91 (Date)

WORKOVER RECOMMENDATION

WELL NAME: Piacentine #1-27 AFE NO: 51006

DATE: 3/19/91 PRIORITY:

DISTRICT: Western FIELD: King Island

ELEVATION: 11.5' KB-THF TD: 4900' PBTD: 4856'

CASING SIZE & SETTING DEPTH: 5 1/2" 15.5#, K-55 LT&C Cemented with 150 sx - TOC @ 4175'

PROPOSED PERFS: 4720'-24' CET, 4721'-25' DN 4SPF

PRODUCING FORMATION: Mokelumne (Perfs 4750'-64')

BOTTOM HOLE PRESSURE DATA: ±2060 PSI (Estimated)

PACKER/ANCHOR: Baker "R-3" Packer @ 4702'

TUBING SIZE & DEPTH: 2 7/8", 6.5# J-55, EUE 8RD @ 4702.14'

PUMP: N/A

RODS: N/A

WELL HEAD: 11" 3M X 7 1/16" 3M

LAST PRODUCTION TEST: 0 BOPD 190 MCFPD " CHOKE

REASON FOR WORKOVER: Recomplete to shallower zone w/in Mokelumne Sand. Present interval depleting.

PREPARED BY: Thomas M. Stone TMS RESERVOIR DEPT.:

PRODUCTION DEPT.: APPROVED BY:

WORKOVER PROCEDURE

1. MIRU rig. R/U on tree. PI well w/ 9.4 PPG brine water and kill well. Fill tubing annulus as required. N/D tree. N/U bop's.

2. Release packer. Circ out. POOH slow keeping hole full.

3. R/U wireline. Make gauge ring and junk basket run to ±4750'. Set wireline EZSV @ 4730'. GIH w/ stinger. Test retainer on casing to 1000 psi. Squeeze cement perforations 4750'-64' using 50 sx cement. POOH.

4. GIH w/ production setting as before. Set production packer @ ±4600'. Test packer to 1000 PSI on casing.

5. N/D bop's. N/U and test tree. Swab fluid down to 1200'. R/U and test lubricator. GIH w/ 1 11/16" thru tubing perf gun. Perforate. 4720'-24' CET 4 SPF.

6. Unload and test well as needed. Obtain gas sample. Release rig.

DIVISION OF OIL AND GAS
CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company Pontana Petr. Corp Well No. "Placentia" 1-27
API No. 077 20484 Sec. 27, T. 3N, R. 5E, MD B.&M.
County San Joaquin Co. Field

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs: Velan 5" 3/03/86	
Mi Analog 5"	
Sybron 5"	
GBC 5"	
Comp. Cal. Log 5"	
TDT 5"	
Mud 2"	

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Waterflood	
Abandoned - Oil		Steamflood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole		Air Injection	
Producing - Gas		Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas		LPG Injection	
Gas-Open to Oil Zone		Observation	
Gas Storage		Waterflood Source	

DATE "E" well Yes ☐ No ☐
RECOMPLETED
REMARKS

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.)
2. Electric Log
3. Operator's Name
4. Signature
5. Well Designation
6. Location
7. Elevation
8. Notices
9. "T" Reports
10. Casing Record
11. Plugs
12. Surface Inspection
13. Production
14. E Well on Prod., enter EDP
15. Directional Survey

CLERICAL CHECK LIST

1. Location change (F-OGD165)
2. Elevation change (F-OGD165)
3. Form OGD121 ✓
4. Form OG159 (Final Letter)
5. Form OGD150b (Release of Bond)
6. Duplicate logs to archives
7. Notice of Records due (F-OGD170)
8. EDP (F-OGD42A-1, 2)

077 20484

RECORDS NOT APPROVED RT 9/3/86
Reason: Need:
- (2) well summaries
- (2) well histories
- (2) DIL 2"
- (2) Sonic 2"
- Cut insp. or prod.

RECORDS APPROVED
RELEASE BOND
Date Eligible
(Use date last needed records were received.)
MAP AND MAP BOOK

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B.&M.

WORK PERFORMED	STATUS	DATE
Drill ____ Redrill ____ Deepen ____	Producing _____ "E" well Yes ☐ No ☐	
Plug ____ Alter Casing ____	Recompleted Producing _____	
Waterflood ____ Water Disposal ____	Waterflood _____	
Abandon ____	Water Disposal _____	
Other _____	Abandoned _____	
	Other _____	
	MAP AND BOOK _____ Engineer _____	

RECORDS FILED AND DATE Clerk ____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 ____

Correct records _____ OGD165 ____
(Specify)

EDP _____ (OGD42A-1, 2) ____

CARDS _____

BOND _____

Hold ____ Reason _____

Release ____ Date Eligible _____ OGD150 ____

End premium year ____

Release requested ____

Bond superseded ____ (Check One)

Well abandoned ____

Environmental Inspection _____ Engineer ____

FINAL LETTER _____ OG159 ____
and
File cleared _____ OGD121 ____

OGD2 (LONG BEACH)

Form OG100 (7/79)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
SEP 29 1986
WOODLAND, CALIFORNIA

04-077-20484

WELL SUMMARY REPORT

Operator: QUINTANA PETROLEUM CORPORATION	Well: PIACENTINE #1-27
Field: Rio Blanco	County: San Joaquin; Sec. 27; T. 3N; R. 5E; B.&M. M.D.
Location (Give surface location from property or section corner, street center line and/or California coordinates): 3490' North along section line and 990' East at right angles to said line from the SW Corner of Section 27 (SE NE Section 27)	Elevation of ground above sea level: - 6.5' GR

Commenced drilling (date): 7/4/86

Completed drilling (date): 7/9/86

Commenced producing (date): Waiting on pipeline connection

☐ Flowing ☐ Pumping ☐ Gas lift

Name of producing zone(s): Mokelumne

Total depth: (1st hole) 4900' (2nd) (3rd)

Present effective depth: 4856'

Junk:

Depth measurements taken from top of: ☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing

Which is 13' feet above ground

GEOLOGICAL MARKERS	DEPTH
T. Domengine Sd.	3790'
T. Capay	4570'
T. Mokelumne	4673'

Formation and age at total depth: Mokelumne, Cretaceous

	Clean Oil (bbl per day)	Gravity Clean Oil	Percent Water including emulsion	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production (Test)			-0-	10 MMCFD	1635	2000
Production After 30 days						

CASING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New or Second Hand	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)
8 5/8"	Surface	627'	24#	K-55 ST&C 8Rd	New	12 1/4"	260	
5 1/2"	Surface	4900'	15.5#	K-55 LT&C 8Rd	New	7 7/8"	150	

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

4764'-4750' (LDT/CNL), 4" gun, 8 jspf

Was the well directionally drilled? If yes, show coordinates at total depth
☐ Yes ☒ No

Electrical log depths
CBL 4822'-3940', TDT 4814'-3800', CET 4816'-3950'

Other surveys
None

In compliance with Sec. 3215, Division 3 of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name: J. M. Williams	Title: Production Technician
Address: 1050 - 17th Street, Suite 400	City: Denver, Colorado; Zip Code: 80265
Telephone Number: (303)628-9211	Signature: J M Williams; Date: 9/26/86

SUBMIT IN DUPLICATE

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

Operator QUINTANA PETROLEUM CORPORATION Field or County San Joaquin County
Well PIACENTINE #1-27, Sec. 27, T 3N, R 5E, M.D.B. & M.
A.P.I. No. 04-077-20484 Name J. M. Williams (Person submitting report) Title Production Tech. (President, Secretary or Agent)
Date September 26, 19 86.

Signature J M Williams

1050 - 17th Street, Suite 400, Denver, Colorado 80265 (Address) (303)628-9211 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date

Please see attached detail sheets

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 686-185

DIVISION OF OIL AND GAS

Report on Operations

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Dr., Suite 133
Bakersfield, CA. 93309

Woodland Calif.
July9, 1986

Your operations at well "Piacentine" 1-27, API No. 077-20484, Sec. 27, T.3N, R.5E, M.D.B.& M. -- Field, in San Joaquin County, were witnessed on 7/5/86. R. Thesken, representative of the supervisor, was present from 0500 to 0700. There were also present R. Bowles, Drilling Foreman.

Present condition of well: 8-5/8" cem. 625'. T.D. 628' (Standing cemented).

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION: The blowout prevention equipment and its installation on the 8-5/8" casing are approved.

NOTE:

1. Deficiencies noted and to be corrected:

   a. Leak in hydraulic line to annular BOPE.

RT/sd

cc: Co., Denver, CO.

077 20484

M. G. MEFFERD

By John C. Sullivan RLH-
John C. Sullivan

OG109 (3/83/GSR1/15M)

Gary #14
7/3/86

RLH

DIVISION OF OIL AND GAS

BLOWOUT PREVENTION EQUIPMENT MEMO

T _____

Operator Quintana Petroleum Well "Sunrise" 1-22 Field _____ County San Joaquin

VISITS:	Date	Engineer	Time	Operator's Rep.	Title
1st	7/5/86	Johnson	0500 to 0700	R. Boles	D.F.
2nd			to		

Casing record of well: 8 5/8" csg 625' T.D. 628 (Standing cemented)

OPERATION: Testing (inspecting) the blowout prevention equipment and installation.
DECISION: The blowout prevention equipment and its installation on the 8 5/8 "casing are approved.

REQUIRED BOPE CLASS: III B 2M

Proposed Well Opns: drill ahead MPSP: _____ psi
Hole size: 12 1/4 " fr. surface ' to 625 ' , _____ " to _____ ' & _____ " to _____ '

CASING RECORD (BOPE ANCHOR STRING ONLY)					Cement Details	Top of Cement	
Size	Weight(s)	Grade(s)	Shoe at	CP at	[illegible]	Casing	Annulus
8 5/8	24#	K 55	625		[illegible]		returns

BOP STACK

API Symb.	Ram Sz.	Mfr.	Model or Type	Size (in.)	Press. Rtg.	Date Last Overhaul	a Gal. to Close	b Rec.Time (Min.)	a/b Calc. GPM Output	psi Drop to Close	Secs. to Close	Test Date	Test Press.
		Hyd			2000							7/5	1000
					✓							✓	1500
					✓					✓	Comp	✓	1500

ACTUATING SYSTEM

Accum. Unit(s) Wkg. Press. 3000 psi
Total Rated Pump Output _____ gpm
Distance From Well Bore 204 ft.

	Mfr.	Accum. Cap.	Precharge
1	Koomey	88 gal.	1500 psi
2		gal.	psi

CONTROL STATIONS	Elec.	Hyd.
✓ Manif. at accum. unit		✓
✓ Remote at Drlr's. stn.	✓	
Other:		

EMERG. BACKUP SYST.	Press.	Wkg. Fl.
✓ N2 Cyl No: 6 Type:	1 2000	gal.
Other:	2 ✓	gal.
	3 ✓	gal.
	4	gal.
	5 ✓	gal.
	6 ✓	gal.

AUXILIARY EQUIPMENT

	No.	Sz. (in.)	Rated Press.	Connections Weld	Flan.	Thrd.
✓ Fill-Up Line						
✓ Kill Line						
✓ Control Valve(s)						
✓ Check Valve(s)						
✓ Auxil. Pump Connec.						
✓ Choke Line						
✓ Control Valve(s)						
✓ Pressure Gauge						
✓ Adjustable Choke(s)						
✓ Bleed Line						
✓ Upper Kelly Cock						
✓ Lower Kelly Cock						
✓ Standpipe Valve						
✓ Standpipe Pressure Ga.						
✓ Pipe Safety Valve						
✓ Internal Preventer						

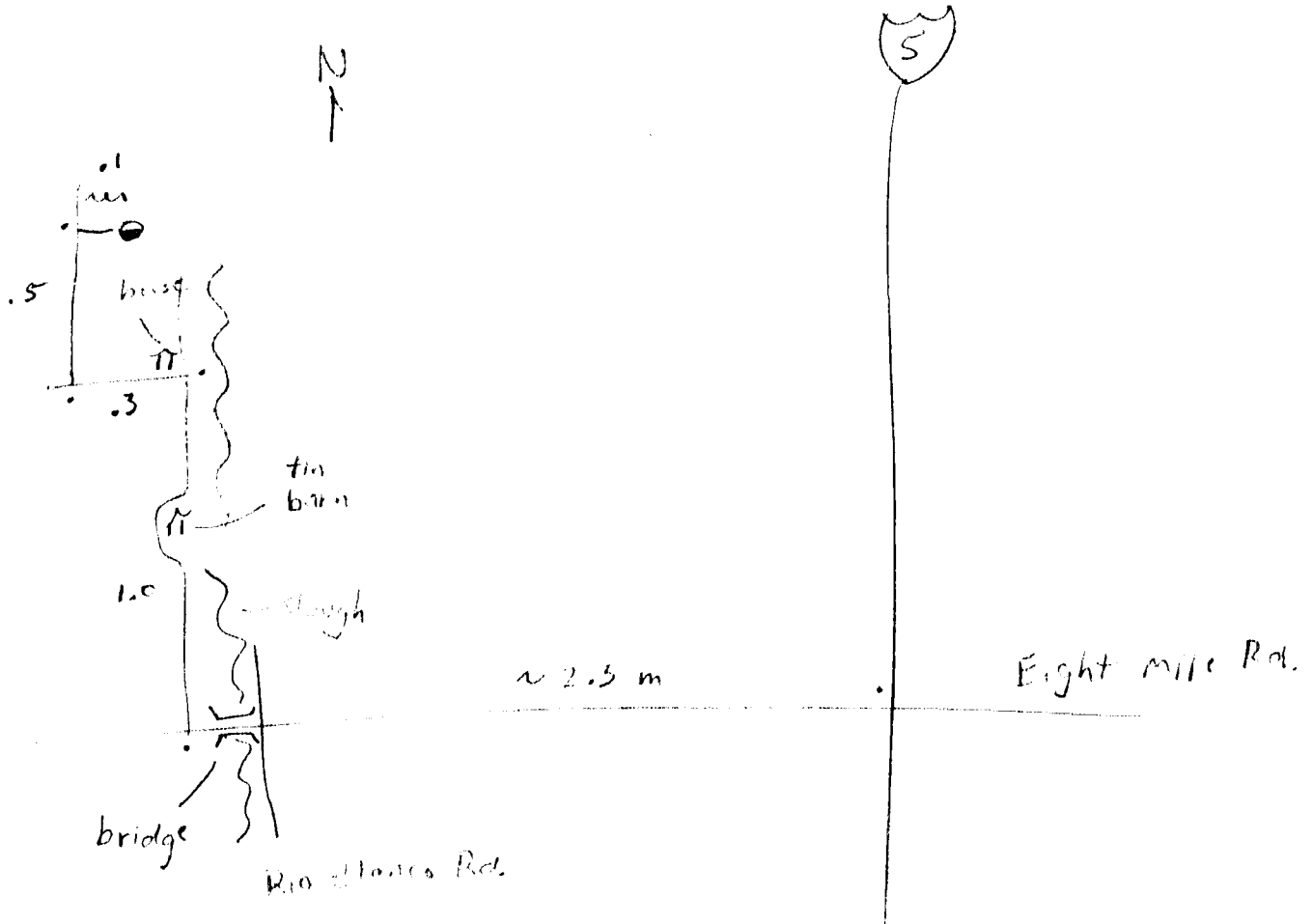
HOLE FLUID MONITORING EQUIPMENT

	Alarm Aud.	Vis.	Class
✓ Calibrated Mud Pit			A
✓ Pit Level Indicator	✓		B
Pump Stroke Counter		✓	B
✓ Pit Level Recorder		✓	B
Flow Sensor			C
Mud Totalizer			C
Calibrated Trip Tank			C
Other:			

REMARKS: Deficiencies
1) Leak in hydraulic line to annular BOPE

Hole Fluid Type	Weight	Storage Pits

OCD9 (10/84/DWRR/3M)


N
5
.1
.5
house
.3
tin
barn
1.5
slough
~ 2.5 m
Eight Mile Rd.
bridge
Rio Vista Rd.

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 686-204

--
(field code)
--
(area code)
--
(new pool code)
--
(old pool code)

REPORT ON PROPOSED OPERATIONS

WELL CLASSIFICATION: Development

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA. 93309

Woodland, California
June 3, 1986

Your _____ proposal to drill well "Piacentine" 1-27,
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B. & M.,
-- field, -- area, -- pool,
San Joaquin County, dated 5/28/86, received 5/30/86 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8-5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 5½" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8-5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 2 M requirements is installed on the 5½" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The division is furnished copies of any draw down or back pressure tests performed. In addition the division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8-5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.

NOTE: 1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 150'.

Blanket Bond
RLH/sd

cc: Co.

M. G. MERRIFIELD, State Oil and Gas Supervisor

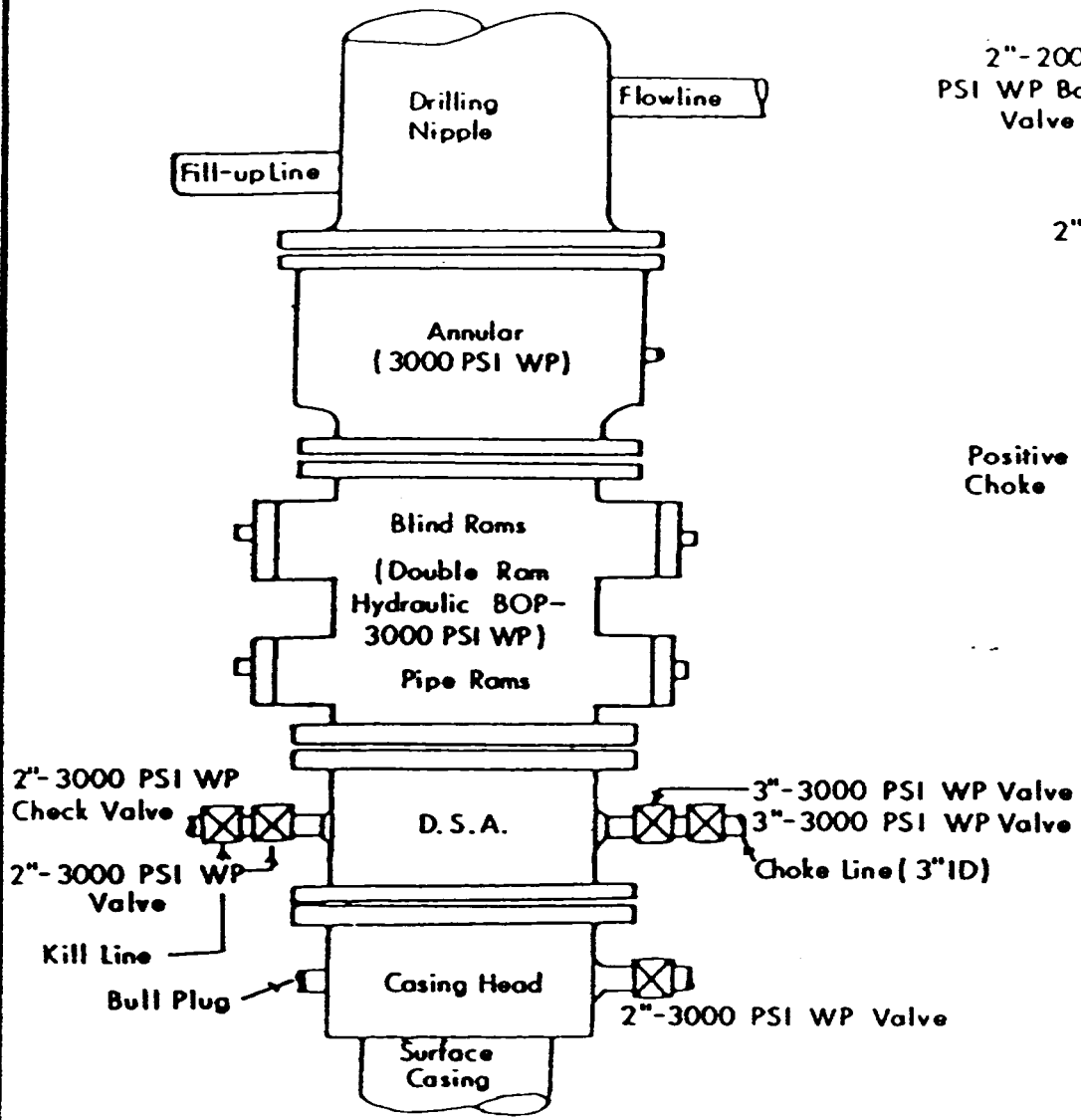
By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this report and the proposal must be posted at the well site prior to commencing operations.

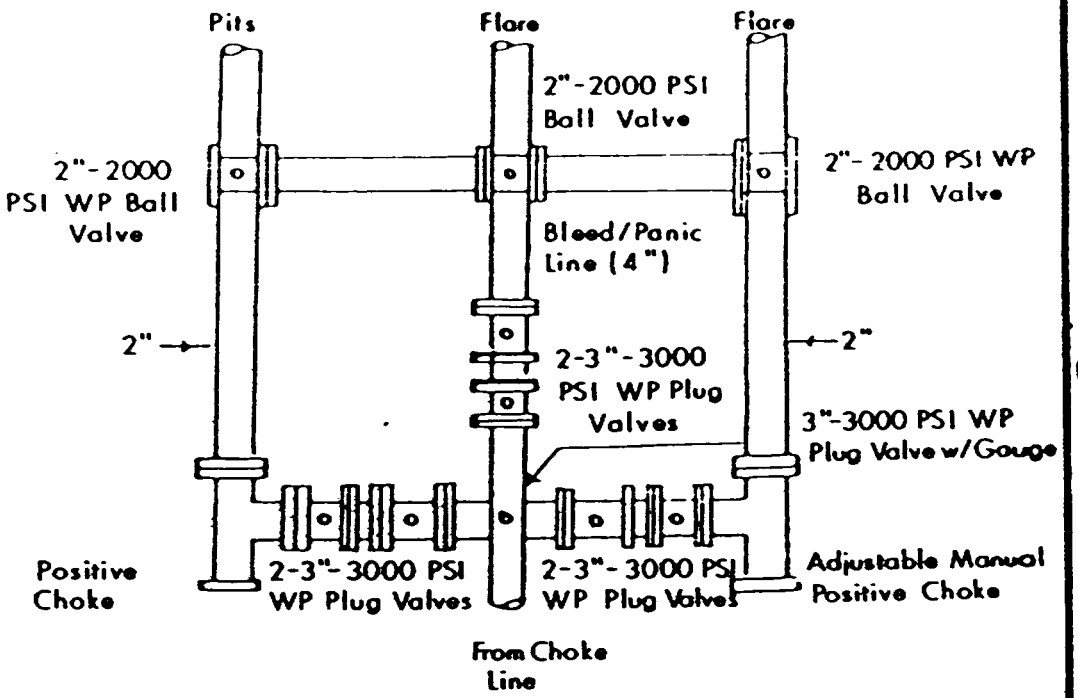
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (11/82/DWRR/5M)

BOP SCHEMATIC
3000 PSI WORKING PRESSURE



PLAN VIEW CHOKE MANIFOLD



The hydraulic closing unit will be located more than 30' from the wellhead. Choke & bleed/panic lines will go to the pit and flare. All connections in choke line and manifold will be flanged or welded. All flanges should be ring joint gasket type. All turns in lines shall be constructed using targeted 90° tees or block ells. All lines shall be anchored.

Quintana *Denver, Colorado*

DIAGRAM #1

DIVISION OF OIL AND GAS
117 WEST MAIN STREET, SUITE No. 11
WOODLAND, CALIFORNIA 95695
(916) 662-4683

June 2, 1986

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Re: QUINTANA PETROLEUM CORP.
"Piacentine" 1-27
Sec. 27, T. 3N., 5E.,
San Joaquin Co.

Dear Mr. Weddle:

This office is in receipt of your request of 5/28/86 regarding confidential status for the above well. The request is denied as the well is classified as a "Development" well. Assembly Bill 3002, which became effective January 2, 1985, restricts confidential status to "Exploratory" wells or "Development" wells where there are extenuating circumstances.

Sincerely,

John C. Sullivan

JOHN C. SULLIVAN
Deputy Supervisor

JCS:cm
cc: John W. Wessels

QUINTANA PETROLEUM CORPORATION
1050 SEVENTEENTH STREET
SUITE 400
DENVER, COLORADO 80265
(303) 628-9211

DIVISION OF OIL AND GAS
RECEIVED
MAY 30 1986
WOODLAND, CALIFORNIA

May 28, 1986

State of California
Division of Oil & Gas
District No. 6
117 W. Main Street, Suite 11
Woodland, California 95695

RE: Piacentine #1-27
Section 27, T3N-R5E
San Joaquin County, California

Gentlemen:

We request that all information received in your office on the subject well be held confidential for the maximum time allowable. Thank you for your attention to this matter.

Very truly yours,

Jeannie Williams
Production Technician

/jw

No "OG" well
Colette Sand
Letter

71-08-22, 44

79077773

RECORDING REQUESTED BY

TENNECO OIL COMPANY

WHEN RECORDED MAIL TO

TENNECO OIL COMPANY

P.O. BOX 9909

BAKERSFIELD, CA 93309

ATTN: DIVISION PROPERTIES

COMPANY SHOWN

SPACE ABOVE THIS LINE FOR RECORDER'S USE

OIL, GAS AND MINERAL LEASE

(SHORT FORM)

THIS LEASE AND AGREEMENT, made and entered into August 30, 19 79

by and between EDWARD H. PIACENTINI and RITA HELEN PIACENTINI, His Wife,

hereinafter called "Lessor" (whether one or more), and TENNECO OIL COMPANY, a Delaware corporation, hereinafter called "Lessee,"

WITNESSETH:

Lessor hereby grants and leases to Lessee and Lessee hereby leases from Lessor the land hereinafter described, for the purposes and with the exclusive right of prospecting, exploring, mining, drilling and operating said land for oil, gas, other hydrocarbons, associated substances, sulphur, nitrogen, carbon dioxide, helium and other commercially valuable substances which may be produced through wells on said land, whether or not similar to the above-mentioned substances. The land hereby leased is situated in San Joaquin County, California, and is described as follows:

See EXHIBIT "A" attached hereto and by reference made a part hereof:

This lease is made for the term and upon and subject to each and all the terms, provisions, covenants and conditions set forth in the certain Oil, Gas and Mineral Lease of even date herewith between the parties hereto covering the land hereinabove described, and said Oil, Gas and Mineral Lease is hereby incorporated herein with the same force and effect as though herein set forth at length.

IN WITNESS WHEREOF, said parties have caused this lease to be duly executed as of the date first hereinabove written.

Edward H Piacentini
Edward H. Piacentini

Rita Helen Piacentini
Rita Helen Piacentini

LESSOR

TENNECO OIL COMPANY

By
Attorney-in-Fact

LESSEE

Brenfell
SUBSCRIBING WITNESS

79077773

EXHIBIT "A"

PARCEL 1 OF CAMP 5:

COMMENCING at a point near the West end of the highway bridge crossing Bishop Cut, said point being marked by a railroad spike stamped R. E. 2909, Driven into the pavement of the G. A. Atherton Road No. 550; said point of commencement being South 88° 23' 30" West, 14,048.79 feet more or less, from the Southeast cornaer of Section 36, Township 3 North, Range 5 East, M. D. B. & M., thence running from point to point along the crown of the levee the following courses and distances North 0° 14' West, 1769.64 feet; North 1° 57' West, 389.90 feet; North 0° 43' West 479.10 feet; North 0° 43' West 2351.90 feet; North8° 47' East, 144.75 feet; North 25° 03' East 425.71 feet, more or less, to the point of beginning, said point of beginning being on the Easterly prolongation of the center line of the existing drainage ditch; thence running along the crown of the levee the following courses and distances: North 25° 03' East, 1177.33 feet; North 8° 41' East 106.58 feet; North 4° 16' West 1835.20 feet; North 19° 04' West 420.85 feet; North 37° 45' West 282.13 feet; North 59° 02' West 1049.15 feet; North 80° 16' West 218.20 feet; South 77° 05' West 843.23 feet to a point lying on the Northerly porlongation of the center line of the present drainage canal; thence, running along the prolonged center line of the present drainage canal, South 0° 38-1/2' East 4065.38 feet to the point of intersection with the prolonged center line of the existing drainage ditch; thence along the prolonged center line, North 88° 18' 10" East 1823.99 feet, more or less, to the point of beginning.

PARCEL 2:

A STRIP of land lying between the Easterly and the Northerly boundaries of Parcel 1 and the outer toe of the levee.

PARCEL 3:

A STRIP of land lying between the Easterly and Northerly boundaries of Parcel 2 (the outer toe of the levee along the Westerly side of Bishop Cut and the Southerly side of White Slough) and a line parallel to and 200 feet Easterly from the outer toe of the levee along Bishop Cut and the center line of White Slough.

End of Description CAA

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS
Notice of Intention to Drill New Well

DIVISION OF OIL AND GAS RECEIVED

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS____	NEG. DEC. ☐ S.C.H. NO.____	E.I.R. ☐ S.C.H. NO.____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☒
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
610	BT 6/1/86	VV	GB	✓	✓

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well Piacentine #1-27, well type Gas, API No. 077-20484 (Assigned by Division)

Sec. 27, T. 3N, R. 5E, M.D.B. & M., ~~Wildcat~~ Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 212.30 acres, is as follows: map attached (Attach map or plat to scale)

(see attached legal description)

Do mineral and surface leases coincide? Yes X No____. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 3490 feet North (Direction) along section/~~property~~ line (Cross out one) and 990 feet East (Direction)

at right angles to said line from the Southwest corner of section/~~property~~ 27 (Cross out one) or

Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) at total depth: N/A feet____ (Direction) and____ feet____ (Direction)

Elevation of ground above sea level -6.5 feet. See letter of 2/4/88

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table, or Kelly Bushing) that is ~~±10'~~ +6.6' feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
		SEE ATTACHED DRILLING PROGNOSIS				

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Mokelumne (Name, depth, and expected pressure) Estimated true vertical depth 4900'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
QUINTANA PETROLEUM CORPORATION	Corporation	
Address	**City**	**Zip Code**
1050 - 17th Street, Suite 400	Denver, Colorado	80265
Telephone Number / **Name of Person Filing Notice**	**Signature**	**Date**
(303)628-9211 J. M. Williams	J M Williams	5/28/86

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

DG105 (9/83/GSR1/5M)

No JCS

Jim Tasker (415) 376-0582

See Kudson SS/ in Denver

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: San Joaquin County Planning Department

Lead Agency Contact Person: Planning Staff

Address: 1810 East Hazelton

Stockton, California 95205

Phone: (209) 944-3722

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks:

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

AFE #56603

QUINTANA PETROLEUM CORPORATION

SHEET A

DRILLING RECORD

PAGE NO. 1

LEASE PIACENTINE WELL NO. #1-27
FIELD KING ISLAND
LOCATION 3490' FSL & 990' FWL
Section 27, T3N - R5E
San Joaquin County, California

PERMIT NO. _____ API NO. 077-20484
T.D. 4900' T.V.D. 4900'
DEVIATION (B.H.L.) Not directionally drilled
COMPANY ENGINEER O. Duncan, Consultant

SPUD DATE 7/4/86 DATE 7/23/86
CONTRACTOR Gary Drilling RIG NO. D-14
TYPE UNIT Rotary Rig
DRILL PIPE DESCRIPTION 14" FH 14.#

ELEVATIONS: GROUND 6.5 MSL
CASING HEAD 5. MSL
TUBING HEAD 7 MSL
ROTARY DRIVE BUSHING 18.5 MSL

APPROVED J. Scott Lombardi

DATE	In DEPTH	BIT NO.	SIZE	MAKE	TYPE	JET SIZE	DEPTH OUT	FEET	HOURS	COND. T/B/G/	FT./HR.	DEPTH & DEVIATION VERTICAL ☐ DIRECTIONAL ☐
7/4	52'	1A	12 1/4	Reed	Y11J	2/16 1/14	628'	576'	6 1/2	3-4-1	88.6	1/4° @ 292'
												1/2° @ 628'
7/5	628'	1	7 7/8	Smith	FDS	3-10	3102'	2475'	19	5-6-1	130	3/4° @ 1140'
												3/4° @ 1899'
												3/4° @ 2998'
7/6	3102'	2	7 7/8	Reed	HP11	2/9 1/10	4294'	1192'	13 3/4	7-5-1	86.7	1/2° @ 3665'
7/7	4294'	3	7 7/8	Reed	HP11	3-9	4900'	606'	7 1/2	7-5-1	80.8	1/2° @ 4900'

AFE #56603

QUINTANA PETROLEUM CORPORATION

MUD RECORD

SHEET B

PAGE NO. 1

LEASE PIACENTINE WELL NO. #1-27 FIELD

TYPE DISTRIBUTOR GEO WESTERN

DATE	DEPTH	WEIGHT	VISC.	W.L.	PH	SALT	OIL	SAND	SOLIDS	REMARKS
7/4	354'	9.3	50	n/c	n/c	n/c	0	-	-	
7/5	628'	9.2	38	-	-	-	-	-	-	
7/6	3102'	9.3	37	6.2	8.5	500	0	1/4	7	
7/7	4294'	9.6	37	6.4	8.5	550	0	1/4	9	
7/8	4900'	9.5	35	7.0	8.5	450	0	1/4	8	
7/9	4900'	9.4	35	7.0	8.5	400	0	1/4	8	

AFE #56603

QUINTANA PETROLEUM CORPORATION

WELL RECORD

SHEET C

PAGE NO 1

LEASE PIACENTINE WELL NO. #1-27 FIELD

CASING & TUBING RECORD

SIZE	WEIGHT	THREAD	GRADE	DEPTH	REMARKS
8 5/8	24#	ST&C 8Rd	K-55	627'	Cem. w/260 sxs. "G"
5 1/2	15.5#	LT&C 8Rd	K-55	4900'	Cem. w/150 sxs. "G"

PERFORATING RECORD

DATE	INTERVAL	F.T.D.	REASON	PRESENT CONDITION
7/22	4750-4764'		Production	Open.

INITIAL PRODUCTION

DATE	INTERVAL	NET OIL	CUT	GRAV.	C.P.	T.P.	CHOKE	MCF	GOR	REMARKS
7/24	4750'-4764'	---	---	---	2000	1635	14/64"	10,000	---	Test

WELL HEAD ASSEMBLY

TYPE:

CASING HEAD: 11" x 3M# x 8 5/8" SW w/BP and Gray gate valve

CASING HANGER: 11" x 5 1/2" Casing Slips & Seal Assembly

CASING SPOOL:

TUBING HEAD: 11" 3MP x 7 1/6" w/ 1 2 1/16" WK Gate Valve

TUBING HANGER:

TUBING HEAD TOP:

MASTER VALVES:

CHRISTMAS TREE TOP CONN.:

SALCH CO FORM NO 1966

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

PAGE NO. 1

AFE #56603

LEASE PIACENTINE WELL NO. 1-27 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
		Location: 990' E & 3490' N of SW corner of projected Section 27, T3N-R5E San Joaquin County, California
7/4/86	354'	Day 1. Drld 302', drlg, clay and sd, MW 9.3, vis 50. Survey: ¼° @ 292'. MIRU Gary Drilling Rig D-14. SPUD at 2401 hrs 7/4/86. Drld and surveyed to 292'. POOH for plugged bit, drld to 354', NDA. DC: $9295 CTD: $9295
7/5/86	628'	Day 2. Drld 274', testing BOPE, sd and clay, MW 9.2, vis 38. Survey: ½° @ 628'. Drld to 628', made wiper trip to surface, circ and cond mud. POOH. Ran 16 jts 8 5/8" csg and set at 627'. Cmt w/BJ/Titan using 160 sx class "G" cmt + 8% gel + 3% $CaCl_2$ and 100 sx class "G" cmt + 3% $CaCl_2$. Total slurry volume 461 cu ft (75% excess). PD at 1348 hrs 7/4/86 w/1000 psi. Release press and float held OK. Had 100 cu ft clean cmt returns (22% excess). Ran 4 centralizers: 1 - 10' above shoe, 1 on each of next 3 collars. WOC, weld on csg head and test, NU BOPE and test, test witnessed by D.O.G. representative. DC: $30,409 CTD: $39,704
7/6/86	3102'	Day 3. Drld 2475', circ for TFNB, sd and clay, MW 9.3, vis 37, WL 6.2. Surveys: 3/4° @ 1140', 1899' and 2998'. Drl out insert, cmt and shoe. Drld and surveyed to 3102', now prep to TFNB. DC: $9957 CTD: $49,661
7/7/86	4294'	Day 4. Drld 1192', drlg, sd and clay, MW 9.6, vis 37, WL 6.4. Survey: ½° @ 3665'. TRNB, drld to 3665', wipe hole to 2840', drld to 4294', TFNB. DC: $7788 CTD: $57,449 Formation tops: Deadhorse at 3590' Domengine at 3793'
7/8/86	4900'	Day 5. Drld 606', TIH, sd and clay, MW 9.5, vis 35, WL 7.0. Survey: ½° @ 4900'. Drl to 4900'. Circ, wiper trip, strap DP. TIH. Circ and cond for logs, TOOH, log, TIH. DC: $15,190 CTD: $72,639
7/9/86	TD 4900'	Day 6. Drld 0', running csg, MW 9.4, vis 35, WL 7.0. TIH, circ and cond, WO csg, LD DP and DC's, now running 5½" csg. DC: $24,710 CTD: $97,349
7/10/86	TD 4900'	Day 7. Ran 124 jts 5½" csg, set at 4900.00'. Circ 3/4 hr, cmt w/BJ Titan using 300 gal weighted mud sweep followed by 150 sx Class G containing 10% salt, 0.75% CD-31, 0.2% FP-8. Displace w/115.6 bbls fresh wtr. Total slurry volume - 174 cu ft, weight 16.0 ppg, yield 1.16 cu ft/sk. Bump plug w/1250 psi. Release press, float held OK. PD at 1030 hrs 7/9/86 PDT. Good returns throughout. Set slips, ND BOPE, install tbg head, clean mud tanks. Rig released at 2300 hrs 7/9/86. Now WO completion. DC: $38,456 CTD: $135,805
7/18/86	4858'	RU Welex and run CBL. LTD at 4824'. DTD at 4858'. Log 4822'-3940'. Excellent bond. Cmt top at 4175'. RD Welex.
7/19/86	4858'	RU Schlumberger. Run TDT log 4814'-3800'. LTD at 4822'. Run CET log from 4816'-3950'. LTD at 4822'. No channeling indicated by CET. RD Schlum.
7/20/86	4858'	Shut down - will MI rig Monday.
7/21/86	4858'	Shut down - will MI rig today.

SALCH CO. FORM NO 1966

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

PAGE NO. 2

AFE #56603

LEASE PIACENTINE WELL NO. 1-27 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
7/22/86	PBTD 4856'	Day 1. MIRU Weltech Rig #246. NU BOPE and tested to 2000 psi, TIH w/bit and scraper. Tagged cmt top at 4846'. RU swivel and drld cmt stringers to 4856', SDFN. DC: $11,951 CTD: $147,756
7/23/86	4856'	Day 2. Circ out w/9.4 ppg brine. POOH w/bit and scraper. RU Welex. Press test lubricator to 2000 psi, TIH w/4" csg gun and perf Mokelumne Sd from 4749'-63' w/8 JSPF (CET 7/18/86) = 4750'-64' (LDT/CNL). RD Welex. RIH w/Baker R-3 pkr and "F" nipple and tbg setting, set pkr at 4702' w/1200#. ND BOPE, NU tree. RU swab equip, tag fluid at 100' down. Pulled from 1200', well came in and flowed 31 BW to rig tank. Well clean, SIFN. DC: $25,288 CTD: $173,044
7/24/86	4856'	Day 3. RDMO rig. RU tester, SITP 1850 psi. Opened well and tested on 5 MMCFPD rate for 4 hrs. Attempted to raise rate to 10 MMCFPD, separate burst plate blew. Working on test separator. SITP 1850 psi. DC: $6680 CTD: $179,724
7/25/86	4856'	Day 4. Flowed well at ±10 MMCFD and 1635 psig tbg press for 4 hours. SI well - press immediately built to 1860 psig. After 35 min SITP 1848 psig. Prod .1 bbl wtr (chlorides = 49,000 ppm). Will pull bombs at 1100 hrs today. DC: $8,000 CTD: $187,724 FINAL REPORT.
7/28/86		Correction to final cost to date: $220,415

BALCH CO. FORM NO. 1568

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

PAGE NO. 3

AFE #56603

LEASE PIACENTINE WELL NO. 1-27 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS

7/5/86

8 5/8" Casing Detail

1	Baker 8 5/8" guide shoe	1.15'
1 jt	8 5/8" 24# K-55 ST&C 8rd R-3 casing	39.79'
1	Baker 8 5/8" insert float valve	0.00'
15 jts	8 5/8" 24# K-55 ST&C 8rd R-3 casing	589.12'
	Total casing run	630.06'
	Casing cut off	16.28'
	Casing in hole	613.78'
	Distance RKB to head	13.15'
	Casing set at	626.93'

7/10/86

5 1/2" Casing Detail

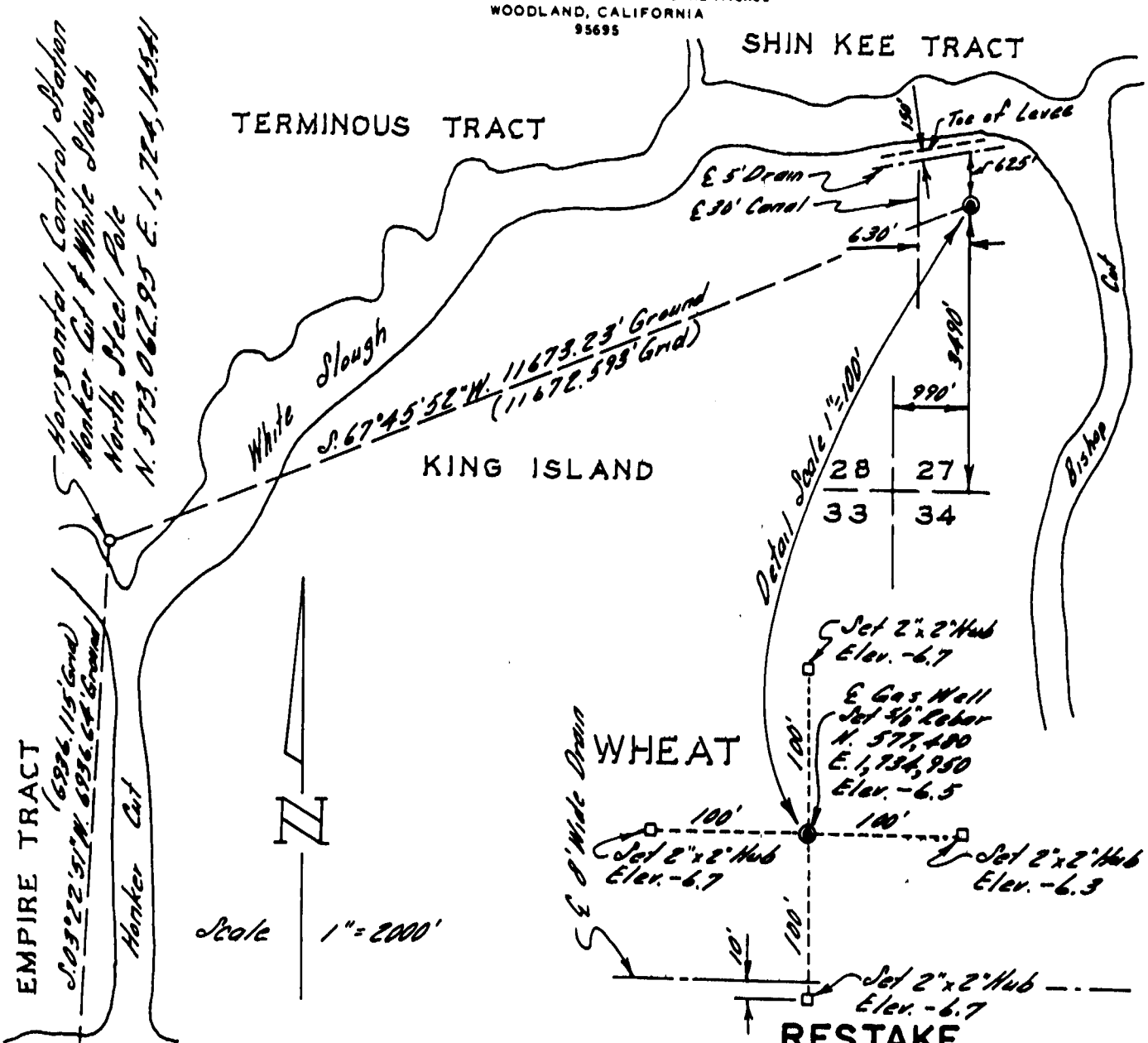
1	Baker guide shoe	0.90'
1 jt	5½" 15.5# K-55 8rd LT&C R-3 casing	39.71'
1	Baker DFFC	1.72'
123 jts	5½" 15.5# K-55 8rd LT&C R-3 casing	4864.25'
	Total casing run	4906.58'
	Casing cut off	19.73'
	Casing in hole	4886.85'
	RKB to CHF	13.15'
	Casing set at	4900.00'

Centralizers (turbolizers) at 4885', 4805', 4765', 4726', 2687', 4648'.

2 7/8" Tubing Detail

1	2 7/8" muleshoe	.88'
1	2 7/8" Model R double grip packer	7.18'
1 jt	2 7/8" 6.5# J-55 tubing	31.14'
1	2 7/8" F Nipple (I.D. 2.31)	.97'
152 jts	6.5# J-55 tubing	4648.17'
1	tubing hanger	.80'
	Total tubing and equipment	4689.14'
	Distance RKB to hanger	13.00'
	Effective tubing setting	4702.14'

YOLO ENGINEERS & SURVEYORS, INC.
WOODLAND PH. 662-4346 • DAVIS PH. 753-2515 • WEST SACTO PH. 371-7076
Post Office Box 1364 1216 Farina Avenue
WOODLAND, CALIFORNIA
95695



NOTE:
Coordinates Based on California State Coordinate System Zone III

R.C.E. 16698 Lic. expires 6-30-89

RESTAKE
GAS WELL SITE
Piacentine No. 1-27
for
QUINTANA PETROLEUM
on
KING ISLAND
Projected T. 3N. R. 5E.
M.D.B. & M.
San Joaquin County, California
May 21, 1986

DRILLING PROGNOSIS
QUINTANA PETROLEUM CORPORATION
Piacentine #1-27
Rio Blanco Prospect
San Joaquin County, California

LOCATION:	990' E & 3490' N of SW corner of projected Section 27, T3N-R5E San Joaquin County, California
PROPOSED TOTAL DEPTH:	4900'
ESTIMATED FORMATION TOPS:	Deadhorse Sand 3590' Domengine 3800' Capay 4590' Mokelumne 4685'
CONTRACTOR:	Not selected at this time.
MUD PROGRAM:	Vendor not selected at this time.

PROPOSED PROGRAM:

Depth:	0'-600'	600'-2500'	2500'-TD
Mud Type:	Spud mud	Gel/Lime	LSND
Mud Weight:	8.8-9.0	8.8-9.3	8.8-9.8
Viscosity:	30-40 sec	30-40 sec	35-45 sec
Fluid Loss:	NC	NC	6-10 cc

CONDUCTOR CASING: 16", set at +/-40'.

SURFACE CASING: 8 5/8" 24# K-55 ST&C set at +/-600'.

CEMENT PROGRAM:

Surface Cement: 220 sx class G cement with 8% gel and 3% $CaCl_2$ followed by 150 sx class G with 3% $CaCl_2$. If cement does not circulate to surface use 1" to top out.

Float Equipment: Guide shoe, insert float, four centralizers and a limit clamp. Run centralizers 10' above shoe, insert collar, and next two collars above insert float.

Production Casing Cement: Volumes and slurry designs will be provided after inspection of open hole logs.

PRODUCTION CASING: 5 1/2" 15.5# K-55 ST&C set at 4900'.

LOGGING PROGRAM: Log well at TD. Service company to be selected. Tentative program is as follows:

DIL-GR-SP - TD to BSC
BHC-Sonic-GR - TD to BSC
*FDC-CNL-GR-Cal - Minimum run

*Check with Engineering Department prior to running the FDC-CNL log.

DRILL STEM TESTS: None scheduled at this time.

DEVIATION SURVEYS:

Depth	Max. Dev.	Max. Rate of Change	*Survey Intervals
0'-600'	1 deg	1 deg/100'	300'
600'-TD	5 deg	1 deg/100'	1000'

*Survey intervals will be based on severity of hole angle, but not to exceed 300' in surface hole and 1000' from BSC to TD.

SPECIAL EQUIPMENT:

1. Manned mud logging unit fully operational from 2500' to total depth. Vendor to be selected.
2. Totco single shot deviation tool (drift only).
3. TIW and inside BOP to bit drill pipe with crossovers to fit drill collars on floor at all times.
4. Have Flo-Sho operational from spud.

HOLE SIZE: 12 1/4" - (0' - 600')
7 7/8" - (600'- TD)

CUTTING SAMPLES: Every 30' from base of surface casing to 4900' (1 set paleo and 1 set dry). Hold at rig.

CONSULTING GEOLOGIST: To be selected. To be on well at total depth.

WELLHEAD EQUIPMENT: Casing Head: Surface sales 8 5/8" OD SW x 11" 3M casing head with 2" 125 psi ball valve and no VR plug/nipple. Located at Surface Sales, Isleton, California - (916) 777-5133. Starter head will be rented and purchased if well is productive.

DRILLING PROCEDURE:

1. Perform rig inspection, and make corrections as needed, prior to spud. Drill and survey 12 1/4" hole to +/-600'. Make conditioning trip to surface. Circulate hole clean prior to pulling out of hole.

2. RU casing crew and run 8 5/8" casing to +/-600' KB. Circulate and condition mud prior to cementing.

3. Cement casing as specified in cement program. Reciprocate pipe +/-15' while cementing until cement returns observed, or until pipe starts to drag. DO NOT reciprocate pipe where casing collar could stop in head if casing stuck off bottom. Should float fail to hold, pressure back up to final pump pressure and hold. Use Class G Neat plus 3% $CaCl_2$ or pea gravel if cement falls in annulus.

4. Wait on cement 4 hours. Install casing head. Test welds to 50% of casing collapse. Install BOPE and Flo-Sho equipment. Have Flo-Sho operational prior to drilling below surface casing. Test all BOPE to W.P. rating except annular. Test annular to 75% of rated W.P. Test casing to 1000 psi (minimum). Notify D.O.G. of BOPE test prior to testing.

5. Wear bushing not needed.

6. Rig up mudlogger at 2500'.

7. Drill 7 7/8" hole to total depth.

8. Conduct operational checks of BOPE daily and/or before trips and note on IADC report. Follow D.O.G. regulations for other BOPE test requirements as outlined on drilling permit.

9. At TD, circulate and condition mud, short trip as directed, and trip out of hole to log. KEEP HOLE FULL.

10. AT TD, log as specified herein or as directed.

11. Complete with 5 1/2" casing or plug and abandon as directed.

DDW:jp
3/27/86

PHONE NUMBERS:

NAME	HOME	OFFICE
Scott Kimbrough (Denver)	(303) 969-9468	(303) 628-9211
John Wessels (Denver)	(303) 987-0540	(303) 628-9211
Lee Knudtson (Denver)	(303) 234-0797	(303) 628-9211
J. M. Trotter (Houston)	(713) 580-2417	(713) 651-8639
C. M. Frick (Houston)	(713) 469-2917	(713) 651-8634

*Division of Oil and Gas (916) 662-4683
District #6 Office
Woodland, California
Mr. Bob Hauser, Engineer

*Verbal notification required:

1. Prior to testing BOPE and surface casing shoe and before drilling out.

2. Prior to plugging.

QUINTANA PETROLEUM CORPORATION
1050 SEVENTEENTH STREET
SUITE 400
DENVER, COLORADO 80265
(303) 628-9211

...SION OF OIL AND G.
RECEIVED
FEB 8 1988
WOODLAND, CALIFORNIA

February 4, 1988

State of California
Division of Oil & Gas
District No. 6
211 West Court Street, Suite #1
Woodland, California 95695

Attention: Mr. Rob Hauser

RE: Piacentine #1-27
SE NE Section 27, T3N-R5E
San Joaquin County, California

Dear Rob:

Per our conversation today, it has come to my attentionthat the elevations submitted on the Notice of Intention to Drill, as well as all subsequent forms, logs, etc., are incorrect. Please note the correct information listed below and change your records accordingly.

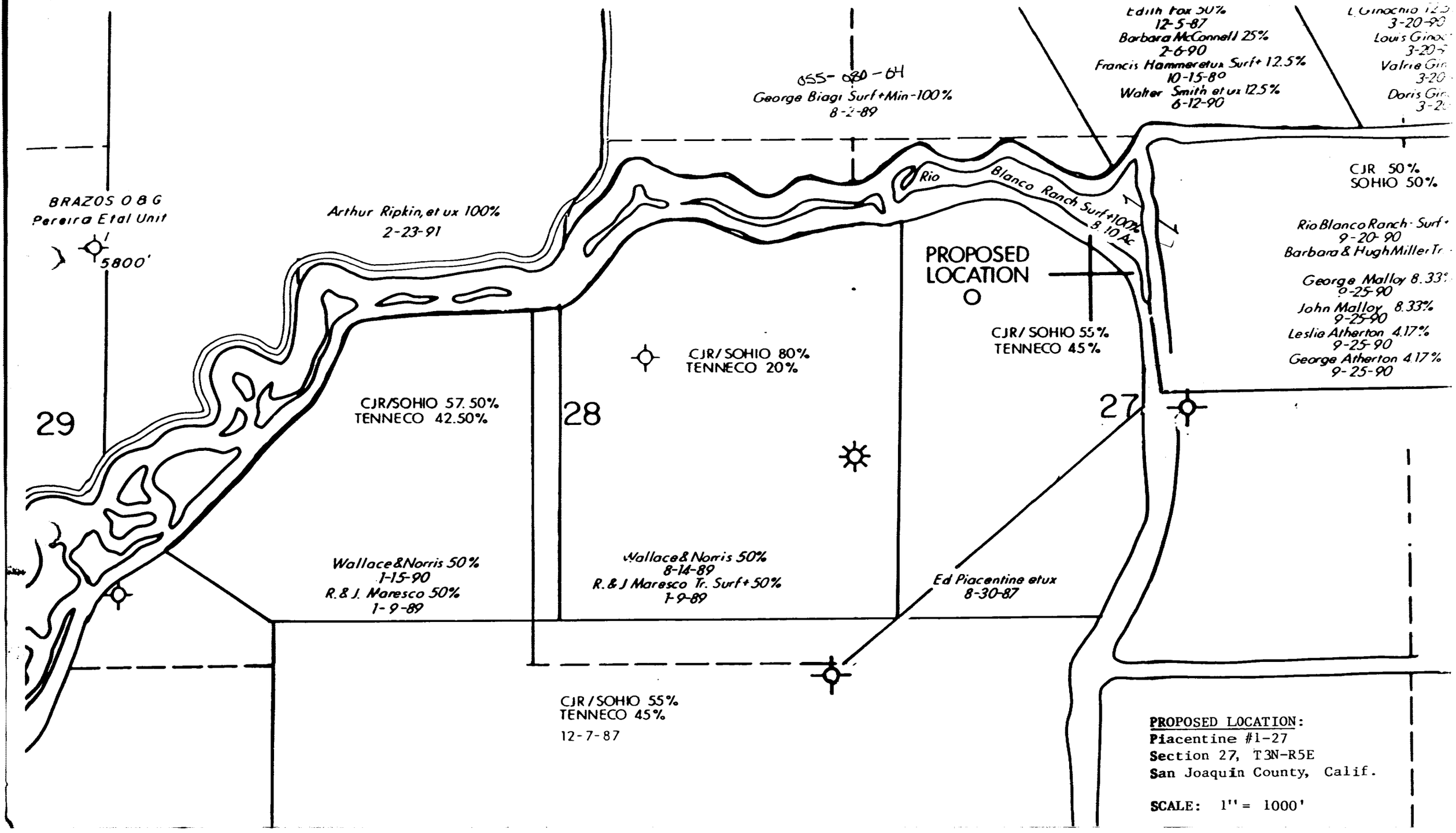
Ground Elevation: -6.5'
K.B.: 6.65'

Please call if you require further information.

Very truly yours,

Jeannie Williams
Production Technician

/jw
cc: Quintana - Houston
Standard Oil Production Co.
Tenneco Oil Company
Jim Tasker
Jim Weddle


BRAZOS O & G
Pereira Et al Unit
5800'
Arthur Ripkin, et ux 100%
2-23-91
055-080-04
George Biagi Surf+Min-100%
8-2-89
Edith Fox 50%
12-5-87
Barbara McConnell 25%
2-6-90
Francis Hammeretux Surf+ 12.5%
10-15-80
Walter Smith et ux 12.5%
6-12-90
Rio Blanco Ranch Surf+100%
8.10 Ac
CJR 50%
SOHIO 50%
Rio Blanco Ranch - Surf+
9-20-90
Barbara & Hugh Miller Tr.
George Malloy 8.33%
9-25-90
John Malloy 8.33%
9-25-90
Leslie Atherton 4.17%
9-25-90
George Atherton 4.17%
9-25-90
PROPOSED LOCATION
CJR/SOHIO 55%
TENNECO 45%
CJR/SOHIO 80%
TENNECO 20%
CJR/SOHIO 57.50%
TENNECO 42.50%
29
28
27
Wallace&Norris 50%
1-15-90
R.& J. Maresco 50%
1-9-89
Wallace& Norris 50%
8-14-89
R.& J Maresco Tr. Surf+50%
1-9-89
Ed Piacentine etux
8-30-87
CJR/SOHIO 55%
TENNECO 45%
12-7-87
PROPOSED LOCATION:
Piacentine #1-27
Section 27, T3N-R5E
San Joaquin County, Calif.
SCALE: 1" = 1000'

APPENDIX 5

Geochemistry Evaluation of the STIG-1 Injection Fluid

EVALUATION OF WATER COMPOSITION FOR DISPOSAL BY INJECTION

STIG PROJECT

Submitted to

NORTHERN CALIFORNIA POWER AGENCY
P.O. Box 663
Middletown, California 95461

by

DON MICHELS ASSOCIATES
P.O. Box 8652
Missoula, Montana USA
406/728-2576

31 March 1994

EVALUATION OF WATER COMPOSITION FOR DISPOSAL BY INJECTION

STIG PROJECT

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NORTHERN CALIFORNIA POWER AGENCY
STIG PROJECT, LODI, CALIFORNIA

EVALUATION OF WATER COMPOSITION FOR DISPOSAL BY INJECTION

DON MICHELS ASSOCIATES
Missoula, Montana, USA
406/728-2576

I. INTRODUCTION

This evaluation considers a sub-surface disposal option for selected waste waters associated with the STIG electric power generation project. Specific issues concern whether or not the liquid may be chemically reactive to yield precipitates that might reduce rock permeability or react with the rock materials in a way detrimental to sustained injection. A thorough description of the project appears in the UIC Permit application. Sections B4 and HK contain basic information about water compositions, plant design, and operating parameters which have been applied to this evaluation.

This evaluation includes a description of how relevant estimates of water compositions were obtained, application of a computer model to identify mineral saturations, and brief discussions about minerals or mineral components that are potential deposits (scales). Silica is found to be a critical component that will cause the combined waste water stream to be not injectable for about one-third of the the time. Recommendations are made for recognizing the unfavorable conditions and for achieving timely diversions of waste water flow away from the injection well. The water, with the proposed processing and treatments, is otherwise generally compatible with injection disposal of selected liquid wastes.

II. LIQUID COMPOSITIONS

A partial flow diagram for the system is shown in Figure 1 which is based on the UIC Permit Application[1]. Source liquid is processed effluent from the City of Lodi White Slough Water Pollution Control Facility (WSWPCF). Water drawn from WSWPCF passes through a filter sequence in the plant, prior to other use. Filtering removes some components that might otherwise be troublesome. Subsequent processing and uses in the plant increase concentrations of most dissolved components in liquid sub-streams. Four sub-streams are combined for injection/disposal, which is the main focus of this review. The several fluid compositions which develop in the plant involve many technical aspects, including their potential to form mineral scales. Such in-plant factors are recognized here mainly in terms of their plausible consequences for injectability of the resulting mixture.

A. Water Compositions

Composition of the source was defined by sampling and chemical analysis over a period of about nine months in 1992-1993. Twenty-six sets of chemical data were available for this review. The first fifteen were obtained during a 26-day interval in October-November 1992. The remainder were obtained at modestly irregular intervals during the succeeding 230 days. Plots of these data are shown in Figures 2A and 2B. No persistent time-trends appear in the data set[2]. Individual component concentrations are generally more variable than ±10 percent of the central values. Irregular shifts in concentration occur for some components, especially silica. Shifts for various components are unsynchronized or weakly synchronized. Average numerical compositions based on these data are used as a basis for modelling. Values are shown in Table 1 where they take several forms.

Column 1: overall average of measured values derived by;

- weighting the average of the first 15 samples as a single composition
- combining that with the unweighted values of the other eleven compositions so that average values are based on twelve sets of data spaced fairly regularly through time

Column 2: median values for the 26-member group

Column 3: column 1 values plus twice the standard deviations

Column 4: design composition used for calculating effects of treatments, particularly reverse osmosis and evapo-concentration processes.

Columns 5-6: Nominal and high compositions of mixed waters representing injectate under different assumptions.

B. Waste Water Streams

The water stream taken from WSWCPF passes through several processes in the plant to yield wastes of different composition. Three major and one minor waste stream are recombined for disposal. One objective of this review aims to define the range of concentrations in the mixture of recombined waste streams, specifically regarding suitability of the mixture for disposal in the injection well. Rates and concentration factors appear in the lower legend of Figure 1.

NORTHERN CALIFORNIA POWER AGENCY
STIG PROJECT - LODI, CALIFORNIA

EVALUATION OF WATER FOR INJECTION

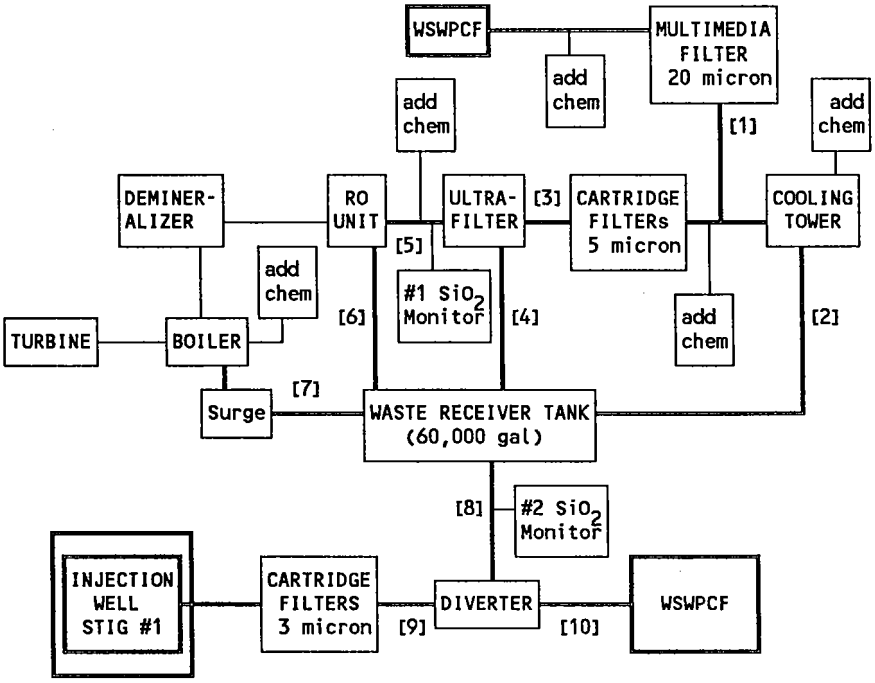

FIGURE 1: FLOW DIAGRAM

FLOW RATES (gpm)

		A	B	C	D	E
	[1]	766	646	728	766	820-
C =	[2]	73	59	100	73	100
	[3]	620	620	528	620	620
U =	[4]	200	108	108	200	200
	[5]	420	420	420	420	420
R =	[6]	130	130	130	130	130
B =	[7]	3	3	3	3	250
	[8]	406	300	341	406	430+
	[9]	200	200	200	200	200
	[10]	206	100	141	206	230+
	mult*	1.86	2.02	2.02	1.86	1.25
	time%	68	50	50	68	100

*net concentration multiplier at the waste receiver tank

FLOW CONDITIONS

A: Mid-range conditions
B: High input concentrations
C: Cooling tower upset
D: Mid-range w/boiler upset
E: Boiler blowdown (surge)

In terms of discharges,

$$\text{mult} = (2.68R + 2C + 1.3U + 0.0094B)/(R+C+U+B) = m$$

In the vicinity of A-type rates;

$dm/dR = +.0020$
$dm/dC = +.0004$
$dm/dU = -.0014$
$dm/dB = -.0046$

time% represents a statistical likelihood that initial silica concentration will be increased by the multiplier value with the final concentration remaining below 120 mg/kg. For 9 months in 1992-1993, silica concentration averaged 59.5 mg/kg with standard deviation 11.2.

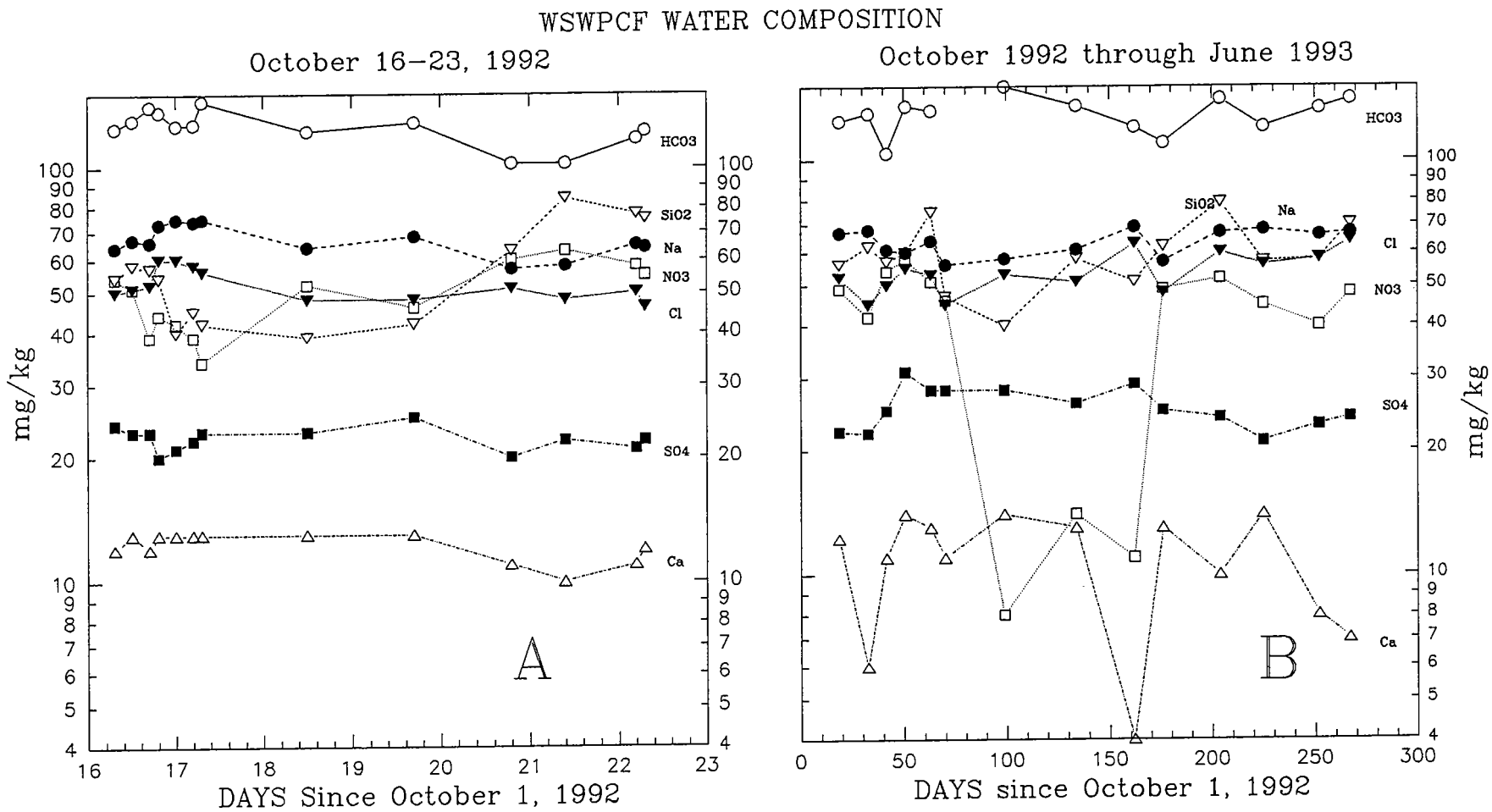

FIGURE 2: CONCENTRATION CHANGES OVER DIFFERENT TIME SCALES

TABLE 1: FLUID COMPOSITIONS
[mg/kg]

	---------WHITE SOUGH---------				WASTE MIXTURES[1]	
	1	2	3	4	5	6
Bicarbonate	131	135	153	123	244	265
Sodium	63.3	63	72.2	63	118	128
Silica	59.5	58	80.8	54	111	120
Chloride	54.8	53	65.8	56	102	111
Nitrate	39.2	45	72.9	40	73	79
Sulfate	25.8	26	31.6	25	48	52
Potassium	13.2	13	15.0	12	25	27
Calcium	11.1	11	17.2	8	21	22
Magnesium	10.3	11	12.6	10	19	21
Phosphate	1.92	1.7	2.62	1.7	3.57	3.88
Fluoride	0.59	0.52	0.97	0.52	1.10	1.19
Barium	0.50	0.050	1.63	0.054		
Iron	0.28	<0.1	0.63	0.03		
Zinc	0.050	<0.05	0.1	0.09		
Copper	-	<0.05	-	0.01		
SUM	411.5	417.3	527.	393.4	765	831
pH	6.93	6.92	7.44	7.0	6.2	6.2
BOD	6.0	4.7	12.0	4.7		
COD	27.3	21	62			
TSS	13.4		15			
Sp. Cond.	587	590	732			
Turbidity	1.22		2.56			

1. Average, weighted (260 days)
2. Median, Russell Associates
3. Column 1 plus 2 standard deviations
4. Design composition, Russell Associates
5. Nominal mid-range (col 1 x 1.86)
6. Nominal high-range (col 1 x 2.02)

[1]Weighted average concentrations based on collective discharge rates mixed in the waste receiver tank.

Filtration

Initial steps in preparing water for plant use involve removal of particulates. This is done in three stages. A multimedia filter removes the bulk of suspended particles, specifically those larger than about 20 microns (>0.0008 inches diameter). Backwash of this filter and subsequent filter pressing operations are forecast to produce about 25 pounds per day (10% moisture) of sludge for disposal.

The water stream passing the multimedia filter is divided. Part goes to the cooling tower and receives a selection of conventional chemicals, but no additional processing. The other part passes through cartridge filters to remove particulates of 5 microns and larger (0.0002 inches). Cartridges are disposed of as solid waste. Fluids passing through the cartridge filters receive chemical additives. Chlorination aims to prevent bacterial growth. Dispersants aim to keep suspended particles suspended so they may be carried away in the liquid stream instead of fouling subsequent units.

Chemically modified fluid enters the ultrafilter which removes particulates as small as 0.1 micron (0.000004 inches). This step is helpful for reducing fouling of the RO unit. Ultrafiltration also causes a mild separation of dissolved materials. Permeate (product) passing the ultrafilter is reduced in dissolved components by a factor (multiplier) in the range of 0.91 to 0.93. The effluent (waste) discharge is more concentrated in dissolved materials by a factor of 1.2 to 1.4, relative to the input concentration. The numerical values of these concentration multipliers vary modestly with the ratio of product to waste and with the condition (age) of the filter material. This stream also carries particulates and enters the waste receiver tank where it is the least concentrated of the three major streams mixed there. It may be regarded as providing a mild dilution effect. Product from the ultrafilter goes to the reverse osmosis (RO) unit.

Reverse Osmosis

Molecular size holes in the RO membrane enable a separation in which about three fourths of the input water passes through the membrane, becoming product, while carrying only five to ten percent of initial amount (by weight) of dissolved salts. Effluent from the RO unit at STIG will be more concentrated than the input by factors near 2.9. This stream carries the largest single contribution of dissolved components to the mixture intended for injection/disposal, but is volumetrically smaller than the ultrafilter waste during normal operations.

A variety of additives are used to control chemical deposition on the membranes where concentrations can be locally high. Internal concentration multipliers exceed 2.9, which represents an average related to gradients near the membrane. Some added chemicals are intended for this environment, to suppress deposition on and in the membrane. Selection of additives depends on the composition of input liquid and the concentration factor involved with the separation effects. Control of pH is important and usually involves reducing natural alkalinity by adding a small stream of sulfuric acid.

Silica in the WSWCPF source water is the component which limits the concentration effect that is practical in the RO unit at STIG. Normal operation at STIG results in those silica concentrations reaching, and sometimes exceeding, concentrations which could yield silica scales. Such deposition could plug the RO membrane. Careful and continued avoidance of plugging is one essential part of the proposed operations, which involves added chemical dispersants.

Similarly, silica which threatens the RO membrane also threatens the injection well. In normal operations, waste from the RO units becomes mildly diluted in the mixture of waste streams which is eventually directed to the well. Chemicals added to prevent silica deposition in the RO membrane will appear as residuals in the injectate mixture. Whether or not those residuals are effective for preventing solids from forming in the waste mixture is an important factor not currently resolved. Even their effectiveness at the membrane, based on limited experimental testing, contains ambiguities.

Those uncertainties could appear acceptable to in-plant operations, but are of greater concern for injection[3]. Consequently this review assigns no effect to the residual dispersants.

Cooling Tower

The effect of evaporation on the concentrations of residual salts in cooling tower liquid is aimed at a factor of two. In that case, silica will not become a problem there. Nominal concentrations in blowdown from the cooling tower will be intermediate between those of ultrafilter waste and RO waste. Cooling tower blowdown carries residuals of corrosion inhibitors, algacides, and bactericides to mixtures in the waste receiver tank.

Demineralizer

The product stream from the RO unit goes to the demineralizer where remaining salts are removed by ion exchange. Output from the demineralizer is approximately as free of salts as distilled water, suitable as input for the boiler. Silica, at fractional mg/kg concentrations, leaves the demineralizer in product which feeds the boiler.

Boiler Blowdown

Additives to the boiler water contribute more to the its composition than do effects of evapo-concentration on the fluid's initial contents. Inflow water to the boiler contains very low levels of dissolved materials, mainly trace levels of silica. Corrosion inhibitors, etc., operate to maintain pH in the alkaline range, >9, nominally 10.4. This contrasts with the other waters which are maintained slightly acid, near pH 6.2. Higher pH strongly inhibits corrosion while enhancing solubility of silica.

Normal liquid waste discharge rate from the boiler is continuous at 3 gpm (≈4300 gal/day). In a steady-state that would result in about a 120-fold concentration effect between inflow and liquid discharge, but steady state is not expected. The low concentrations and generally low rate of contribution to the waste mixture cause this part of boiler blowdown to be an insignificant contribution to the overall waste composition and amount[4].

In addition to the continuous discharge, the boiler also will be discharged at a rate of 250 gpm two or three times per day for a few minutes each time (≈5000 to 7000 gal/day). Discharge at boiler temperature, (268°F, ≈25 psig) is associated with steam flashing which is controlled in a surge tank. Residual liquid at boiling temperature then enters the 60,000 gallon waste receiver tank. This inflow causes transients of temperature and concentration that cannot be readily modelled. Details of the transients depend on actual level of liquid in the tank, manner by which hot water enters the pool, and current inflow rates of other waste steams.

Waste Receivor Tank

Waste streams from the ultrafilter, cooling tower, RO unit, and boiler are collected in the waste receivor tank (60,000 gallon capacity). This tank provides a place to mix the several waste streams, providing a more predictable and uniform injectate. It also provides a damping effect for surges due to boiler blowdown. As a reservoir, it helps accomodate changes in rate of waste water disposal.

Effects related to surging and mixing depend on the time that incoming parcels of liquid actually spend in the tank. For any one parcel, passage out of the tank may be described as a logarithmic dissipation. At nominal conditions, the working volume of the tank (<60,000 gal.) provides a residence time of about an hour or more. More precisely, a nominal half-time for clearance of an initial liquid parcel from the tank will vary depending on fill level and inflow rate[5]. Half-times on the order of one hour may be expected[6].

Relatively steady conditions of input to the tank are punctuated by blowdowns from the boiler, two or three times per day, when the rate changes suddenly from 3 gpm to 250 gpm, and back. Combining the surges into the steady boiler blowdown yields about 8 gpm, as an average for longer time intervals. Insertion of boiler blowdown imparts a nominal, momentary average concentration decrease of 5 to 10 percent, relative to the mixture composition prior to the boiler addition. Nominal average temperature effect will be a rise of 6° to 12°F, depending on current fill level[7].

Over time, surge effects from the boiler addition will both mix across the tank contents and dissipate due to discharge from the tank, the latter in accordance with current conditions which define residence half-life. Depending on conditions, this would permit a maximum of five to ten percent of the original (average) impact to be still present when the subsequent surge occurs[8].

Prior to boiler-induced surges, water composition in the tank could be within ±1 percent (relative) of a computed average based on composition and inflow rates of the three major, steady waste streams. Deviations from that, induced by boiler discharges, will not be large, and larger deviations will necessarily be associated with shorter lifetimes and smaller affected volumes.

Effects of boiler alkalinity on the tank mixture will yield less than a 0.02 pH unit increase on the average fluid. This is less than the precision (±0.1 pH unit) used when estimating pH in the fluid mixtures. Transients near the point of insertion of the boiler discharge will be stronger than elsewhere, and cannot be defined sufficiently for precise modelling. Effects several times the average could still be regarded as negligible.

Boiler discharges would have detectable effects in the waste receiver tank and transients there may have locally important effects. But, those effects may be expected not to propagate to the injection well in any important way. Thus, review of mineral deposition potential for fluid discharges from the receiver tank could be represented usefully by mixture compositions based on blending the three main waste stream compositions in proportion to their flow rates. It is recognized that dilutions of ten percent and temperature increases of 12°F are plausible, but quickly transient. Those transients should be recognized as being of the same relative magnitude as variations in the input water composition and temperature on which this assessment is based (Table 1).

Multiplier for Overall Concentration of Waste Water

The sub-systems described above each operate to increase the concentration of their liquid input streams and the concentration in waste represents the average concentration effect of the sub-systems. Whether or not the final, mixed waste fluid is injectable depends jointly on the average concentration effect and on the concentrations in initial liquid. Since initial liquid concentrations are substantially variable (Figure 2, Table 1), it is useful to view the collection of sub-systems in a mechanical way. The objective is to derive a numerical factor which accounts for concentration effects that can be used irrespective of details about the initial liquid[9].

At nominal conditions, the ultrafilter yields different concentrations in product and waste, respectively about 0.92 and 1.3 times the concentration of input fluid[10]. The RO unit receives ultrafilter product and about 10 percent[11] of that dissolved load exits in the RO product stream. The net concentration multiplier[12] for the RO is 2.68. Cooling tower opearation is aimed at a concentration factor of 2.0 due entirely to evapo-concentration. Losses of dissolved materials from the tower water are considered negligible, so the concentration factor of 2.0 requires no modification[13]. Boiler discharge, when at low rate, contributes negligibly to the volume and dissolved load of the waste mixture. During high-rate blowdown, it contributes a dilution effect. Its effective concentration multiplier[14] is approximately 0.0094.

Applying those concentration factors to the corresponding liquid volume rates and summing, then dividing the result by the sum of volume rates yields the effective concentration multiplier (m) for the system. Equation (1) is explicit, wherein R, C, U, and B refer to volume rates of waste discharge from RO, cooling tower, ultrafilter and boiler, respectively.

$$(2.68R + 2.0C + 1.3U + 0.0094B)/(R + C + U + B) = m \qquad (1)$$

At nominal conditions, m = 1.86. For summer conditions C and U are smaller than nominal and this yields a larger multiplier, m = 2.02. Descriptions of alternative flow rate combinations and resulting concentraton multipliers are shown in the legend of Figure 1.

III. MINERAL SOLUBILITY ESTIMATES

Applying eq. (1) to the average concentration of SiO_2 in input fluid yields 59.5(1.86) = 110.7, a predicted average concentration in injectate. Silica is considered a critical component and evaluation of its potential for deposition is relatively simple. This is because the form which deposits is well known and the effect of other dissolved materials, normally electrically charged, do not appreciably interact with dissolved silica, which is mostly electrically neutral.

Other mineral forms, involving ionic components, are potential deposits and descriptions of them are worthwhile. Evaluating complete water compositions for potential mineral depositions can be done by classical methods which allocate analyzed components among the many ionic and molecular forms that are significant to mineral saturation. Mathematical requirements involve solving several tens of simultaneous equations which can be practical by computerized methods.

WATEQ4F[15] was applied to the WSWPCF fluid based on the average concentrations, increased according to multipliers derived above and shown in Table 1. They represent the plausible range to expect in operation of STIG. WATEQ4F contains data for more than 600

minerals, but in each review, only those minerals with all components occurring in a given fluid composition are tested for saturation. With the WSWPCF fluids, 39 mineral species were involved with the major and minor dissolved components. Another 62 mineral forms were considered in regard to trace concentrations of iron, copper, and zinc. A great majority of these mineral forms are not apparently supersaturated and may be disregarded. Among those that are identified as supersaturated, some, like silica varieties quartz, chalcedony, etc., do not deposit for reasons related to their atomic mechanisms of growth.

Mineral species identified by WATEQ4F to be super-saturated and plausibly capable of forming under injection conditions are shown in Table 2. That may be regarded as a nominal maximum listing, given the available chemical analyses. Identified minerals involve a fairly wide range of dissolved components and the several forms deserve separate consideration. Accordingly, a "Level of Concern" has been attached to each mineral listed in Table 2.

A. Silica Forms

Several crystalline forms of silica (SiO_2) are known and all are super-saturated according to the chemical model, which is based solely on thermodynamics. They include quartz, chalcedony, and cristobalite. However, experience shows that even when greatly supersaturated, these species do not form in environments such as at STIG. Accordingly, only chalcedony is shown in Table 2 as an intermediate representative of the group.

An amorphous (non-crystalline) form of silica does deposit readily when super-saturated in industrial contexts. SiO_2 concentrations are very close to the saturation concentration in the "nominal" case and exceed saturation, due to statistical variations, to seasonally high plant concentration factors, and to excursion conditions in the plant. Silica concentrations in the RO membrane will normally reach saturation conditions and chemicals will be added to prevent problems there.

Amorphous silica is a critical component in regard to injection/disposal. Silica concentrations are forecast to range on both sides of the solubility limit, but chemical additions have ambiguous (not reliable) effects on stabilizing concentrations that exceed the solubility. Consequently there will be times when injection/disposal should be precluded.

Silica can also be a component of other minerals with more complicated compositions and those require separate evaluations. Such minerals include silicates of sodium and potassium and alumino-silicates, some of which contain magnesium. Alumina was not analyzed, but concentrations in natural waters normally are very low (<0.1 mg/kg). Alumino-siliceous minerals were disregarded. Silicate minerals containing magnesium were not indicated as being near saturation in the nominal compositions.

B. Heavy Metals

Concentrations of iron, copper, and zinc are low and variable in the unprocessed slough water. For two reasons, their measured concentrations should not be taken at face value. Indicated concentrations are near the analytical detection limits, so resolution of concentrations are likely no better than a factor of two, possibly poorer. Apparent concentrations exceed solubility by relatively large multipliers, especially for iron, suggesting that detected material is present as

TABLE 2: MINERAL DEPOSITION POTENTIAL

Mineral Name	Composition	DEPOSITION (mg/kg*) 5	DEPOSITION (mg/kg*) 6	Level of Concern
Amorphous Silica	$SiO_2 \cdot 2H_2O$	-6	11	Important
Chalcedony	SiO_2	94	110	negligible**
FCO_3 Apatite	$Ca_{9.5}Na_{0.36}Mg_{0.14}(PO_4)_{4.8}(CO_3)_{1.2}F_{2.5}$	39	48	Uncertain
Fluorapatite	$Ca_5(PO_4)_3F$	0	0	negligible
Hydroxyapatite	$Ca_5(PO_4)_3OH$	0	0	negligible
Fe chlorohydroxide	$Fe(OH)_{2.7}Cl_{0.3}$	≈0	≈0	negligible
Goethite	FeOOH	≈0	≈0	negligible
Barite	$BaSO_4$	≈0	≈0	negligible

* Based on the liquid reaching zero supersaturation
[Deposition of 1 mg/kg represents about one pound per day from 100 gpm.]
** Natural protection via unfavorable reaction kinetics
5 Nominal average injectate
6 Seasonal high concentration (winter)

particulates, not as dissolved forms. Particulates would be removed by the filtration sequence. Solubility calculations presume dissolved forms, so using the apparent concentrations for computing mineral stabilities could yield results that are biased, probably strongly biased toward high apparent supersaturation.

By using apparent concentrations of heavy metals in the solubility calculations, several iron- and copper-bearing minerals can be identified as "super-saturated" in the processed waters. These should be regarded as minerals capable of forming in the STIG environment, but probably it is false to consider that they will form, due to factors described above. Even accepting such computed indications of mineral deposition, the amounts implied are small. They would likely be of negligible operational concern in any case.

These same, or related, iron-bearing minerals could also form if corrosion occurred to ferrous parts of the plant equipment. Thus, development of iron mineral deposits could remain an item of interest, but their presence would more reasonably be taken as an indicator of corrosion, rather than an indicator of deposition from water-born components. Some representative mineral names and compositions are listed in Table 2, where they are indicated to be of negligible concern to plant operations.

C. Phosphate Minerals

Orthophosphate, ionic units of composition $H_{3-n}PO_4^{-n}$, are common, natural components of water at low concentrations. Polyphosphates and phosphonates are larger, more complicated molecular and ionic forms, commonly added as water treatment chemicals and some are programmed for addition in the STIG plant.

Polyphosphates tend to partly decompose to orthophosphate. Orthophosphate combines with calcium and other ionic components, notably fluoride, carbonate, and hydroxyl, to form a variety of mineral forms collectively known as apatite. The most common scale variety, hydroxy-apatite, and a natural form, fluorapatite, were indicated by WATEQ4F as not being over saturated in any mixed or single waste water. However, an uncommon form, containing magnesium, fluoride, and carbonate, was indicated to be over saturated. The potential amount of deposition is large, but the likelihood of any deposition seems poorly defined[16].

When water treatment chemicals are present, especially dispersants, which contain polyphosphate, etc., apatite minerals that manage to form tend to be fine-grained. These may accumulate as sludge, to be removed periodically from places of accumulation (e.g. stagnant parts of cooling tower), or as suspended particles which are removed continuously by filtration units. Since sludge removal and cartridge filters are part of the system design for STIG, the formation of apatite may be regarded as a normal part of plant operations, presenting no serious or unforseen risks beyond timely removal operations.

Higher pH and warmer temperatures favor formation of apatite minerals, so they could be formed intermittently during transient conditions within the waste receiver tank, especially in the vicinity of boiler surge input. If particulates do form there and become suspended, they could be removed by cartridge filters maintained between tank and injection well.

Potentially, these phosphate minerals could form as hard crusts (scale) but the planned dispersants tend to prevent such development. Because the amounts which might form are

significant and because they could form as crusts, if uncontrolled, the associated level of concern (Table 2) is given as "moderate". So long as dispersants have their intended effects and the liquid is filtered prior to injection, phosphate mineral formation in the plant would present no threat to operation of the injection well.

Residual polyphosphates and phosphonates may be expected to continue their slow decomposition to orthophosphate after injection to the geologic medium. In principle, this would result in deposition of apatite minerals along the fluid flow pathways. In a practical sense, the low rate of decomposition, compared to the fluid flow rate and associated distance from the injection well, may be expected to yield a negligible impact on the rock permeability near the wellbore.

D. Sulfate Minerals

Elements barium and strontium are indicated to be present at low concentrations in the WSWPCF water, but, like heavy metals, the actual concentrations are poorly resolved. In particular, barium sulfate is highly insoluble and would be expected to form barite at the measured concentrations of barium and sulfate. One could expect particulate barite to be removed early in the filtration sequence.

Celestite, strontium sulfate, is more soluble than barite, and is marginally susceptible to precipitate. Strontium concentrations of about 1 ppm were observed in some of the early chemical analyses (not shown in Table 1) but analyses were reported irregularly. If celestite formed, it would behave similarly to barite.

For both minerals, only small amounts would form, if any. Their presence could add, in a minor way, to the bulk of sludge, etc., but would not present any new issues substantially different from the sludges which contain phosphate minerals and dusts scavenged from air at the cooling tower.

IV. DOMENGINE FORMATION

Rocks

A generalized stratigraphic column (NCPA 7/10/91) describes the Domengine as two sandstone members separated by a sandy shale member.

sandy shale member: *sandy to clayey shale with interbedded very fine to medium grained quartzose sandstone. Marine origin.*

sandstone member: *massive, fine to coarse grained, predominantly quartz with orthoclase, plagioclase, glauconite, and lithic fragments. Kaolinite and lignite in lower member. Crossbedded and commonly fining upward. Marine origin.*

The high proportion of quartz and tectosilicate minerals suggests a negligible reactivity with injectate waters at relevant temperatures. Formation of alumino-silicate minerals utilizing silica from the injectate and aluminum from kaolin, etc., may be expected negligible due to the near neutral pH and low temperatures.

Formation Water

A partial chemical analysis for a sample of formation water taken from the injection well

indicates;

TDS=14066, Cl=7000, HCO_3=62, CO_3<1, Ca=761, Mg=86, SiO_2=16.5, pH=7.85.

Reaction of injectate with this composition may involve formation of apatite when high concentrations of calcium and modest concentrations of bicarbonate mix with significant concentrations of phosphate and fluoride. Limited deposition should be expected because the zone of mixing is relatively narrow and moves away from the wellbore as injectate displaces native fluids. Amounts of deposition would be limited by amounts of orthophosphate and fluoride in the injectate and mixing zone. Accordingly, less deposition may be expected in the rocks than is indicated in Table 2 because some of the limiting fluoride and orthophosphate will have been removed, prior to injection, as sludge or in filters.

Heavy metals are expected to be negligible in the Domengine formation water due to the abundant bicarbonate and moderate pH.

V. WELL COMPONENTS

The well contains casing, tubing, and screens made generally from carbon steel. Corrosion should be avoided and the injectate appears neutral in this regard. Filtration and ultrafiltration likely remove BOD so the waters will not have much capacity, if any, as chemical reducers. Sodium sulfite is added at multiple places in the plant, notably to cooling tower liquid to reduce levels of dissolved oxygen. All injectate mixtures are dominated by streams that have been purposefully depleted in oxygen so all injectates may be expected non-oxidizing, initially. However, small amounts of air, inadvertently allowed into injectate, could convert the liquid from neutral to mildly oxidizing, because liquid carries no buffer to consume minor inputs of oxidizers.

Injectate waters contain substantial amounts of important nutrients, especially nitrate, sulfate, and phosphorous. Thus, the injection well may be considered as potentially threatened by bacterial accumulations. Bactericides are among the intended additives to fluid entering the ultrafilter and to the cooling tower. Residuals in the injectate would be helpful for protecting the well. Some attention should be given to augmenting residuals of bactericides in injectate, as appropriate. Low levels of BOD will help suppress bacterial accumulation.

VI. SILICA MONITORING AND FORECASTING

The variability of silica concentrations in fluid from the WSWPCF complicates the tactic of injection/disposal. For statistically substantial increments of time, the system multiplier, operating on above-average silica concentrations, will yield wastes exceeding 120 mg/kg. That value designates a limit for safe injection/disposal[17]. Based on the apparent standard deviation for the silica concentrations, injection will be safe for about two-thirds of the time[18,19].

Part of the discharge from the waste receiver tank always will be directed back to the WSWPCF because the injection well capacity is smaller than the normal plant discharge rate. At times when silica concentrations are favorable, discharge from the waste receivor tank can be divided, 100 or 200 gpm may directed to the injection well, STIG #1, with the balance, ≈200 to

≈300 gpm going to WSWPCF. When silica concentrations are not favorable, all the discharge from the waste receiver tank must be directed to WSWPCF. This section describes how silica concentrations may be monitored to control acceptable splitting of the waste stream.

Timing Aspects

Less than 5 mg/kg separate the average concentration (59.5 mg/kg) from the critical concentration (64.5 mg/kg). Figure 2A shows that silica concentrations can shift at least as quickly as 1 mg/kg per hour for a few tens of hours. When monitoring silica concentrations, a component of time will be involved with obtaining an analytical result for water currently in the process stream. In practice, a trend cannot be identified with fewer than three sequential samples, and verification could require a fourth and plausibly a fifth sample. Subsequent increments of time will be required to review the data in order to make a decision about changing the split of discharged waste.

Once the well is closed, stagnant, supersaturated fluid could deposit minerals in sensitive porosity near the wellbore. The resting time after closure will favor deposition of a tiny increment of mineral as the chemical aspects approach equilibrium. There may be other practical altenatives[20], but over the life of the project, many occasions of closure, each with an individually tiny effect, could have a significant cumulative effect. Accordingly a good effort should be made to respond quickly enough to a rising silica concentration that even these small increments of deposition are avoided. Of course, responding too soon carries a statistical risk that a projected rise in silica concentration does not actually reach the critical level, resulting in loss of advantage that injection is intended to give. Too slow a response risks mineral deposition in rock porosity near the wellbore.

Monitoring and Data Review

The description above appears to require a capability to respond within a small number of hours. Two, or so, could be a reasonable target. This could be met by continuous, or semi-continuous analysis of silica in selected parts of the in-plant flow system. Two silica monitoring locations are indicated in Figure 1. Automated sampling frequency of three per hour, or faster, would be satisfactory. An automated method of reviewing results should be considered because substantial periods of time will pass in which no symptom of risk would be apparent. The automated data review system should respond both to near-critical concentrations and to high rates of change of concentration.

Location of silica monitor #1 is indicated (Figure 1) on the discharge of the ultrafilter. This is considered superior to upstream alternatives for analytical reasons. Silica in WSWPCF water may not be entirely monomeric, but it is the monomeric form that is of concern with calculated saturations. Ultrafiltration will probably remove most of the extraneous varieties, providing for a more reliable analytical result from the sampler.

Locating the sampler at an alternative, downstream location, such as the RO waste streams, reduce the practical response time for the system. Also, a concentration measured there must be compensated by the current RO concentration factor before it could be reliably applied to other units. Associated error or uncertainty would propagate unfavorably in the arithmetic of assessment.

To use the monitoring results, combine them with a multiplier (m*) derived from equation

(2) based on current discharge rates for the sub-systems.

$$(2.91R + 2.17C + 1.41U + 0.010B)/(R + C + U + B) = m^* \quad (2)$$

Coefficients differ between eqs. (1) and (2) because the #1 silica monitor tracks concentration after the mild separation effect of the ultrafilter. The logic is otherwise identical for both equations. [Alternatively, a reasonable facsimile of m* might be used to simplify an automated response system. This would require verifying "alert" signals with a genuine value for m*, current for the sampling time.] If the product of (m*)(conc) exceeds 120, or if the rate of change of (m*)(conc) seems aimed past 120, injection should be precluded.

Silica monitor #2, sampling the discharge mixture from the waste receiver tank (Figure 1), has two roles. During times when silica concentrations are sub-critical, it serves a verification function. Its output should be consistent with the concentration indicated by monitor #1 multiplied by a current value for m*. Mis-match should trigger a system check to find the cause.

During times when silica concentrations are greater than critical, a wait ensues for when injection may again become a safe option. Decision to re-start injection should coincide with both silica monitors returning to sub-critical indications.

VII. SUMMARY

A calculated range of injectate fluid compositions has been derived from chemical data for the source water, effects of plant processes, and blending proportions of the several process streams. An equation was derived for computing the net concentrating effect on input water in terms of the waste discharge rates of sub-systems in the plant. Selected compositions were used as input to a computer program which identifies chemical saturation for more than 100 relevant minerals over a wide range of compositions. About a dozen minerals were identified as near saturation or super-saturated in terms of the liquid compositions.

Dissolved silica is found to be a critical component. Solid, amorphous silica is calculated to form at conditions expected in the STIG operation, from waters that are modestly higher than average in silica. Accordingly restrictions on injection/disposal are recommended, based on silica concentrations derived from continuous monitoring. A system for monitoring silica is proposed, including methods for using the data in decisions about whether or not to inject the waste into a well.

A variety of phosphate minerals and barite are expected to form in the plant and to be routinely removed as sludge and filtrate. Chemical additives are specifically identified to discourage those minerals from forming as hard crusts (scales).

Several iron- and copper-bearing minerals appear supersaturated, but their actual presence is doubtful due to analytical factors. Amounts that might form from liquid components would not be significant in any case. Formation of iron-bearing minerals should be regarded as an indicator of active corrosion, not chemical deposition, and treated on that basis.

Reaction of injectate with natural waters in the receiving rocks may yield minor amounts of phosphate minerals. However, expected dispersion would result in their causing no significant impairment to the injection zone. Other potential reactions between injectate and formation water

and between injectate and formation minerals appear to be of negligible likelihood or significance.

The use of water from WSWPCF for the STIG project will yield waste water mixtures that are variably suitable for injection/disposal, but only one component, silica, is critical in that regard. Diversion of the waste stream to the injection well or return to WSWPCF can be based on monitoring silica.

NOTES AND REFERENCES

1. Russell Associates, Supplementary Environmental Impact Report, STIG Project, Northern California Power Agency.

2. The earliest plotted points in Figure 2B represent the averages of points plotted in Figure 2A.

3. Testing of polyacrylate materials from two suppliers was reported in March 1994 (Al Benenati, Nalco). Concentrations to twice the natural solubility of amorphous silica (240 vs. 120 mg/kg) were reached in waste streams. However, chemical data provided to this reviewer was ambiguous for showing whether or not silica deposition occurred in the membrane.

Three of five tests with two chemicals at two levels of addition showed that some silica was not accounted for. Specifically, mass balance verification was possible from measured silica concentrations in input, concentrate, and permeate. The discrepancy is plausibly explained by deposition in the membrane. However, the amounts indicated were at about the level of resolution of the chemical analyses. If analytical results are to be accepted, it must be concluded that silica deposited in the membrane. Alternatively, if the analyses are not accepted, which may also be reasonable, the tests must be judged as too insensitive for a conclusion to be made.

Comments about pressures associated with the test suggest that no deposition occurred. Also, analyses of the membranes were said to not show silica. No pressure records or membrane data were provided. Thus, chemical data are compelling for this review. Accordingly, no credit for chemical stabilization of silica is accepted here, regarding injection, when silica concentrations exceed the nominal solubility limit of 120 mg/kg.

4. The standard deviations for concentrations of liquid components are mostly in the range of 10 to 15 percent of the concentration values. That describes a normal variation of input water composition. Factors causing changes smaller than the range of natural variation may be regarded as negligible for many aspects of this review.

5. Normal input rate for the three main waste streams is about 406 gpm. If discharge from the tank is the same rate, so that a stable liquid level is maintained, then clearance of the tank occurs at (406/V) [working volumes per minute], where V is the liquid (working) volume held in the tank. The tank will be operated at less than its 60,000 gallon capacity in order to accommodate surges and minor upsets in the system. Thus, V could be nominally 30,000 gallons, but an engineeringly practical range could be from 5000 to 40,000 gallons. A 30,000 gallon level yields a clearance rate of 0.0135 volumes/minute.

6. That clearance rate can be recast into the concept of a time to clear half of a parcel of liquid initially in the tank. Numerically, a clearance rate of 0.0135/min is equivalent to a clearance half-time of $t_{1/2}$=0.853 hours. Lower (winter) rates involve average discharges nearer 314 gpm which have correspondingly longer clearance half-times for the same fill levels of the tank. On the other hand, if the operating level of the tank is less than 30,000 gallons, clearance half-

times would be shorter for the same input/discharge rates. For example, a stable level of 5000 gallons with throughput of 406 g/m has $t_{1/2}$ = 0.14 hours (8.5 min).

7. Sharp increases in temperature and decreases in concentration are not initially well mixed throughout the tank. Volume of boiler blowdown will be nominally 1/10 to 1/20th the volume in the tank.

8. For a maximum half-time of 2.4 hours with 8 hours between surges, a given surge effect is reduced to about $(1/2)^{8/2.4}$ = 0.10 of the initial (average) impulse. This is a maximum residual because a maximum half-time (2.4 hrs) was used in the estimate.

9. Separation factors vary with differences in input concentrations and with the volume ratio of permeate to waste. Also, different ions and molecules have their individual separation factors for any specific environment. These may be largely considered as secondary, minor factors that merely alter the details about the main effects. By considering the present system to be limited to the vicinity of nominal conditions, secondary effects will be negligible. Applicaton of these results to remote conditions risks inaccuracies, depending on true magnitudes of the secondary effects, which are not investigated.

10.For the range of operation of the ultrafilter (100 to 200 gpm discharge with 520 to 620 gpm input), concentration multipliers range from 1.4/.93 to 1.2/.91, where the numerator refers to the ratio of waste/input concentrations and the denominator refers to ratio of product/input concentrations. The numerically lower pair corresponds to larger relative (volumetric) waste rates. A mid-range pair, 1.3/.92, will be used for the nominal conditions modelled in this review.

11. Based on data for silica obtained during testing described by Al Beninati, 1994, Results of Ionics Test run on TX8665: Letter report to Northern California Power Agency, 8 March. [Attn: Scott Eddy].

12. A crude concentration factor (cf) for the RO is given by the ratio of input/waste volume rates, diminished by the portion (y) of dissolved component that follows permeate. For nominal rates and y=10%, cf_{true} = (1-0.10)420/130 = 2.91. Given that the RO input is depleted from the initial liquid concentration by the ultrafilter factor, 0.92, the effective RO mutiplier is 2.91(0.92) = 2.68.

13. Sludges removed from the cooling tower originate variously as depositions from the fluid and particulates scavenged from the atmosphere. Added chemicals partly aim to prevent deposition of water-borne components and these are more or less successful.

14. The boiler surge water contains silica at a concentration predicted to be less than 8 mg/kg. This is a result of evapo-concentration in the boiler operating on finite, residual concentrations of silica which pass through the RO and demineralizer units. Based on silica concentration in the original liquid, the internal multiplier for the boiler amounts to $<8/59.5 \approx 0.13$. Since the boiler surge discharge enters the accumulated volume in the tank, is effect is diminished compared to what a steady-state contribution would be. In note 7, the average surge effect was indicated to be a maximum of only 5 to 10 percent of what a steady-state inflow would yield, and that dissipates between surges. Using a mid-range of 7 percent, the internal multiplier of the boiler yields a value of 0.07(.13) = 0.0094 in the waste receiver tank.

15. Ball, J.W. and D.K. Nordstrom, WATEQ4F for calculating speciation of major, trace, and redox elements in natural waters: US Geol. Surv. Open-File Report 91-183, 1991, Menlo Park, California.

16. The crystal composition is complex, suggesting that growth would be difficult, except in (probably) limited circumstances. Additional references were sought, but not found in a cursory review of literature, suggesting an uncommon or rare occurrence. Computed equilibrium deposition potential exceeds 3 tons per month, but no deposition at all seems plausible also. If large accumulations of sludge do not develop during early operations then this variety of apatite may be disregarded.

17. Amorphous silica saturation is reached at 120 mg/kg at 77°F. Concentrations higher than that, risk deposition of silica on available surfaces. For the injection system, critical surfaces include the rock porosity near the wellbore.

18. For a concentration multiplier of 1.86 and concentration limit of 120 mg/kg, maximum input concentration would be 120/1.86 = 64.5 mg/kg. Statistics for measured concentrations are; avg = 59.5, std. dev = 11.2. The maximum tolerable input concentration (64.5 mg/kg) corresponds to +0.45 standard deviations above the average. Based on a Gaussian (normal) distribution, such a normally varying fluid would be injectable 67 percent of the "time".

Irregularities of the silica concentration changes could cause doubt that the distribution is Gaussian. An alternative method to estimate statistical utility of injection/disposal can be based directly on the data. Using the values on which Figure 2 is based, and limiting the tally to different-day samples, 13 of 18 sampling days (72%) had silica <64.5 mg/kg. These two results are not statistically distinct. Nominally, injectability can be expected to be practical for about 2/3 of the time.

19.The procedure above disregards silica inhibitor (dispersant) that is planned for addition to the RO input fluid, specifically to stabilize silica there. Residuals of inhibitor may plausibly be present in the injectate mixture. Furthermore, it could appear practical to augment the inhibitor concentration for fluids which exceed the injectability index in order that they may be "safely" injected. However, at the present level of documentation, the stabilization actually imparted to the supersaturated silica concentrations is ambiguous for conditions in rocks near the wellbore. Until unambiguous support is developed, injection of supersaturated concentrations of silica into the well could be considered imprudent.

20. If chemically active fluid were in the well after closure, it could be displaced by pumping in two, or more, casing volumes of non-active fluid. Alternatively, plant operating conditions might be susceptible to modification yielding a smaller net concentration factor. This would require in-plant adjustments of rates involved with equation (2). The utility of this option has limits which deserve exploration prior to the need.

APPENDIX 6

2006 Title 22 Evaluation of the STIG-1 Injection Fluid

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January 22, 2007

Northern California Power Agency
Attention: Steve Royall
PO Box 1478
12745 N. Thornton Road
Lodi, CA 95241

SUBJECT: NCPA CT-2 Discharge Characterization
Lodi, San Joaquin County

Dear Mr. Royall:

HydroScience Engineers (HSe) was hired by the Northern California Power Agency (NCPA) to assist in responding to a request from the City of Lodi (City) for a chemical characterization of the water discharged from the NCPA CT-2 facility in Lodi to the City's White Slough Water Pollution Control Facility (White Slough WPCF). The first set of required analyses was received by HSe on October 11, 2006. A full review of all laboratory results indicated that some of the results did not conform to the lab's QA/QC standards. It was decided to re-sample for questionable analytes. Additional samples were collected in November, and the final lab results were received by HSe on January 2, 2007.

This letter summarizes all analytical data for the full suite of water quality parameters requested by the California Regional Water Quality Control Board – Central Valley Region in Sacramento (Regional Board). This letter, with our August 9, 2006 letter containing information requested by the City for the City's response to the Regional Board, provides a complete response to the City's requests for information about NCPA's operations.

The parameters for the water quality characterization were specified by the Regional Board in a letter from the Regional Board to the City dated April 21, 2006. The parameter list specified by the Regional Board for the water quality characterization consisted of:

(1) Chemical oxygen demand;
(2) Residual chlorine;
(3) Priority pollutants (December 2001 revision of the Regional Board 13267 list);
(4) Process chemicals listed in the April 5, 2006 facsimile communication from NCPA to the Regional Board, and
(5) Three species chronic toxicity testing using the species and dilution series described in Order 5-00-031.

The April 21, 2006 letter also asked for discharge flow rates and, if intermittent, the temporal pattern of the discharges.

Sampling Program

In accordance with the Regional Board request, NCPA requested FGL Environmental, an ELAP certified laboratory, to analyze both the water received from the White Slough WPCF (influent) and the effluent returned to the White Slough WPCF (effluent).

After a review of the results from the first set of sampling events, it was decided to re-sample for five parameters because of laboratory QA/QC issues. Initial lab results from FGL for **sulfite** and **endrin** carried QA/QC flags which indicated that the laboratory did not feel the reported results were reliable ("did not conform"). **Dichloromethane (methylene chloride)** was not detected in the influent, but was detected in the effluent; because dichloromethane is known to be a common lab contaminant it was selected for re-test. **Pentachlorophenol** was not detected in the influent, but was measured in the effluent at only 0.1 ug/L over the PQL. **The re-test results for sulfite by EPA 377.1, endrin by EPA 3520C/8081, methylene chloride by EPA 5030B/8260B, and pentachlorophenol by EPA625 all were reported as non-detect at the detection levels noted in Table 1.**

Initial **copper** results also appeared questionable, in light of the fact that measurements of metals in high salinity water by standard methods frequently overstate metals concentrations. To gain a more reliable measurement of copper in the influent and effluent, re-test samples were sent to Frontier Geosciences in Seattle Washington. Frontier has developed widely accepted methods for the preparation of high salinity samples for analysis of metals by ICP-MS. The Frontier results are reported in **Table 1**.

This report is based on the following lab reports provided by FGL Environmental, Stockton, California: 636111, 636407, 636525, 636556, 636573, 636872, 636873, 638254, 650014, and 650133. A tabular summary of all of the analytical data contained within these lab results is attached as **Table 1**, and summarized in this document. A summary of the bioassay results is included below, in **Table 2**.

Bioassay Summary:

Table 2 below shows the results of short term chronic toxicity testing performed according to the guidelines prescribed in EPA-821-R-02-013, *Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. In Table 2, "inf" denotes to NCPA influent (WPCA effluent), and "eff" denotes NCPA effluent.

Table 2 – Three Species Bioassay Results Summary

	NOEC inf	NOEC eff	IC25 inf	IC25 eff	IC50 inf	IC50 eff
Minnow – survival	50.00%	12.50%	>100%	20.24%	>100%	40.63%
Minnow – growth	12.50%	25.00%	59.90%	25.18%	>100%	41.46%
Water flea – survival	100%	50.00%	>100%	58.33%	>100%	72.22%
Water flea – reproduction	100%	25%	>100%	35.38%	>100%	51.82%
Algae - growth	25.00%	100%	>100%	>100%	>100%	>100%

The bioassay results for influent and effluent indicate that some part of the impact to the growth of the fathead minnows is attributable to the NCPA influent. The influent No Observable Effect Concentration of 12.5% is lower than the corresponding value determined for the NCPA effluent (25%), indicating that first effects of toxicity were observed at a lower concentration of NCPA influent (12.5%) than NCPA effluent (where first effects were noted at a concentration of 25% NCPA effluent). In addition, the IC25 value of 59.9% for the NCPA influent indicates that 25% of the test population demonstrated inhibition of growth when reared in water consisting of 59.9% NCPA influent (WPCF effluent).

PQLs

Analyses for eight quality parameters used methods with a PQL slightly higher than the quantation limits recommended by Regional Water Quality Control Board, Region Five, in the revised 13267 List released December 2001. The differences in quantation are minimal, and the added cost of special analysis to achieve slightly lower limits is not justified by the limited data which might be gained. The eight parameters are shown in **Table 3**, below, along with the lab PQLs and the Criterion Quantation Limits recommended by the Regional Board in Sacramento. These analytes are flagged with the "**a**" flag in Table 1.

Table 3 – Quantation Limits

Analyte	Method	CQL [1]	Influent PQL	Effluent PQL
1,3 dichloropropene	8260B	0.5 ug/L	NS	1 ug/L
Carbon tetrachloride	8260B	0.5 ug/L	0.5 ug/L	1 ug/L
Vinyl chloride	8260B	0.5 ug/L	0.5 ug/L	1 ug/L
Antimony	200.7	5 ug/L	10 ug/L	10 ug/L
Beryllium	200.7	1 ug/L	5 ug/L	5 ug/L
Lead	200.7	0.5 ug/L	10 ug/L	10 ug/L
Heptachlor	8081	0.01 ug/L	0.05 ug/L	0.05 ug/L
Heptachlor epoxide	8081	0.01 ug/L	0.05 ug/L	0.05 ug/L

Notes
[1] CQL: Criterion Quantation Limit. The quantation limits recommended by Regional Water Quality Control Board, Region Five, Revised 13267 Letter, December 2001.
[2] NS: Not Sampled

Water Conditioning Chemicals

The Regional Board specified analysis for process chemicals referenced in NCPA's facsimile correspondence to the Regional Board dated April 5. HSe's understanding is that the NCPA facility uses sodium hypochlorite and sulfuric acid, which would be detected by other analyses already performed. In addition, HSe's understanding is that the following five proprietary compounds constitute the full list of proprietary process chemicals referenced in Attachment B to the regional Board's April 21 letter:

- Nalco 71D5 Plus Antifoam
- Nalco 7396 Water Stabilization
- Nalco 7346 Microbicide
- Nalco 73199
- Nalco Trasar 23268

Typical flow rates for these parameters were included in NCPA's August 9, 2006 letter to the City. No specific analysis for these parameters was included in this analysis since there are no standard methods for analyzing the concentrations of these parameters.

Discussion

This section includes full discussion of all key results of the water quality characterization. In general, nearly all constituents in the NCPA effluent were either non-detect or were measured at lower concentrations than in the NCPA plant influent. Out of the full suite of analytes, only nineteen constituents were measured at higher concentrations in the effluent relative to the influent. Of these nineteen constituents, only four appeared to exhibit more than a two-fold increase in the effluent over influent. Of these four constituents, only two constituents appeared to exhibit more than a four-fold increase in the effluent over influent Three other constituents yielded results that suggest more than a two-fold increase between influent and effluent, but the data are not conclusive due to sample dilution or a non-detect measurement in one of the samples.

For water quality parameters which were characterized as exhibiting less than a four-fold increase between influent and effluent, no mass loading is proven or implied by the slight increase in concentration of some of the monitored parameters. The measured increase in constituent concentrations, when apparent at all, are less on a percentage gain basis than the typical decrease in water volume through the NCPA process. The water discharge volume is typically 25% to 50% of the water accepted, yet no parameters demonstrated an increase by the 2x to 4x ratio that would be expected from the concentration cycle in effect at NCPA. The most likely explanation for any increase in constituent concentration less than 400% is evaporative concentration, not mass loading by NCPA.

The results of analysis for constituents whose effluent concentrations were measured to be higher than their influent concentrations are summarized in **Table 4**, below.

Table 4 - Constituents with Effluent Concentratons Higher than Influent
Northern California Power Agency, Roseville, Placer County
Samples collected July 20, August 2, 3, 10, September 26, and November 16 2006

WATER QUALITY PARAMETER	ANALYTICAL METHOD		RESULTS OF ANALYSIS			QA / QC	
						Practical	
Constituent	Analytical method used		Results of Analysis			Quantation Limit	
	Influent	Effluent	Units	Influent	Effluent	Influent	Effluent
Greater than a four-fold increase							
Copper	3010A / 200.7	APDC/ICP-MS	ug/L	1.52	10.4	0.02	0.02
Nitrite	EPA300.0	EPA300.0	mg/L	1.9	34.3	0.3	0.3
Less than a four-fold increase							
Mercury	1631E	1631E	ug/L	0.0028	0.0072	0.0005	0.0005
Phosphorus, Total (as P)	EPA300.0	EPA365.3	mg/L	0.5	1.6	0.1	0.5
Less than a two-fold increase							
Fluoride	EPA300	EPA300	mg/L	0.6	0.9	0.1	0.1
Iron	3010A / 200.7	3010A / 200.7	mg/L	0.23	0.32	0.05	0.05
Manganese	3010A / 200.7	3010A / 200.7	mg/L	0.07	0.11	0.01	0.01
Nickel	3010A / 200.7	3010A / 200.7	mg/L	0.08	0.09	0.01	0.01
Sodium	3010A / 200.7	3010A / 200.7	mg/L	184	196	1	1
Zinc	3010A / 200.7	3010A / 200.7	mg/L	0.06	0.07	0.02	0.02
Alkalinity (as $CaCO_3$)	2320B	2320B	mg/L	310	380	10	10
Bicarbonate	2320B		mg/L	380	460	10	10
Total Disolved Solids (TDS)	2540C	2540C	mg/L	1020	1060	40	40
Specific conductance (EC)	2510B	2510B	umhos/cm	1440	1510	1	1
Chloride	EPA300.0	EPA300.0	mg/L	158	171	5	5
Sulfate	EPA300.0	EPA300.0	mg/L	97	122	1	1
Increase sugested, magnitude uncertain							
Cyanide	4500CNCE	4500CNCE	mg/L	ND	0.042	0.005	0.005
Biochemical Oxygen Demand (BOD)	5210B	5210B	mg/L	2.9	77 [c]	2	32
Chemical Oxygen Demand (COD)	5220	5220	mg/L	ND	50	20	20

The only water quality parameters on the December 2001 revision of the Regional Board 13267 list which appear to exhibit a greater than four-fold increase in concentration through the NCPA process are copper and nitrite. It is noted that the NCPA effluent is returned to the headworks of the Lodi WPCF, where it is subjected to considerable dilution, and to constituent attenuation by the WPCF treatment processes, prior to discharge by the City to White Slough. It should also be noted that NCPA's current Wastewater Discharge Permit, (Permit Number 391, issued by the City on 01 March 2006), sets forth a copper effluent limitation of 3.0 mg/L (3,000 ug/L), which is approximately 300 times the concentration of copper measured in the NCPA effluent.

Please feel free to contact me at (707) 254-1900 if you have any questions about this report.

Sincerely,
HydroScience Engineers, Inc.

Steve Ferry, P.E.
Senior Project Manager

Att: Table 1 – Water Quality Monitoring Results Summary
Appendix A – Analytical laboratory reports

Table 1 - Water Quality Monitoring Results

Northern California Power Agency, Roseville, Placer County

Samples collected July 20, August 2, 3, 10, September 26, and November 16 2006

WATER QUALITY PARAMETER			ANALYTICAL METHOD		RESULTS OF ANALYSIS			QA / QC	
CTR #	Constituent	CAS #	Analytical method used		Results of Analysis			Practical Quantation Limit	
			Influent	Effluent	Units	Influent	Effluent	Influent	Effluent
Volatile Organic Compounds						~~	~~		
28	1,1-Dichloroethane	75343	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
30	1,1-Dichloroethene	75354	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
	cis-1,2-Dichloroethene	156592		5030B/8260B	ug/L		ND		1
40	trans-1,2-Dichloroethene	156605	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
41	1,1,1-Trichloroethane	71556	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
42	1,1,2-Trichloroethane	79005	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
	1,1,1,2-Tetrachloroethane		5030B/8260B	5030B/8260B	ug/L	ND	ND	1	1
37	1,1,2,2-Tetrachloroethane	79345	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
75	1,2-Dichlorobenzene	95501	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
76	1,3-Dichlorobenzene	541731	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
77	1,4-Dichlorobenzene	106467	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
29	1,2-Dichloroethane	107062	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
31	1,2-Dichloropropane	78875	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
101	1,2,4-Trichlorobenzene	120821	EPA3520C/625	5030B/8260B	ug/L	ND	ND	5	1
32	1,3-Dichloropropene	542756		5030B/8260B	ug/L		ND		1 [a]
	cis-1,3-Dichloropropene		EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
	trans-1,3-Dichloropropene		EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
17	Acrolein	107028	EPA624	5030B/8260B	ug/L	ND	ND	2	100
18	Acrylonitrile	107131	EPA624	5030B/8260B	ug/L	ND	ND	2	50
19	Benzene	71432	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
20	Bromoform (tribromomethane)	75252	EPA624	5030B/8260B	ug/L	1.1	ND	0.5	1
34	Bromomethane (methyl bromide)	74839	EPA624	5030B/8260B	ug/L	ND	ND	1	1
21	Carbon tetrachloride (tetrachloromethane)	56235	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1 [a]
22	Chlorobenzene (mono chlorobenzene)	108907	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
24	Chloroethane	75003	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
25	2-Chloroethyl vinyl ether	110758	EPA624	5030B/8260B	ug/L	ND	ND	1	10
26	Chloroform	67663	EPA624	5030B/8260B	ug/L	0.6	ND	0.5	1
35	Chloromethane (methyl chloride)	74873	EPA624	5030B/8260B	ug/L	1.1	ND	0.5	1
23	Dibromochloromethane	124481	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
27	Dichlorobromomethane	75274	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
36	Dichloromethane (methylene chloride)	75092	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
33	Ethylbenzene	100414	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
88	Hexachlorobenzene (perchlorobenzene)	118741	EPA3520C/625	EPA625	ug/L	ND	ND	10	1
89	Hexachlorobutadiene	87683	EPA3520C/625	5030B/8260B	ug/L	ND	ND	10	1
91	Hexachloroethane (HCE, perchloroethane)	67721	EPA3520C/625	EPA625	ug/L	ND	ND	10	1
94	Naphthalene	91203	EPA3520C/625	5030B/8260B	ug/L	ND	ND	10	1
38	Tetrachloroethene	127184	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
39	Toluene	108883	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
43	Trichloroethene	79016	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
44	Vinyl chloride	75014	EPA 8260B	5030B/8260B	ug/L	ND	ND	0.5	1 [a]
Semi-Volatile Organic Compounds						~~	~~		
85	1,2-Diphenylhydrazine	122667	EPA625	EPA625	ug/L	ND	ND	1	1
45	2-Chlorophenol	95578	EPA625	EPA625	ug/L	ND	ND	1	1
46	2,4-Dichlorophenol	120832	EPA625	EPA625	ug/L	ND	ND	1	1
47	2,4-Dimethylphenol	150679	EPA625	EPA625	ug/L	ND	ND	1	1
49	2,4-Dinitrophenol	51285	EPA625	EPA625	ug/L	ND	ND	10	10
82	2,4-Dinitrotoluene	121142	EPA625	EPA625	ug/L	ND	ND	5	5
55	2,4,6-Trichlorophenol	88062	EPA625	EPA625	ug/L	ND	ND	10	10
83	2,6-Dinitrotoluene	606202	EPA625	EPA625	ug/L	ND	ND	5	5
50	2-Nitrophenol	52154557	EPA625	EPA625	ug/L	ND	ND	1	1
51	4-Nitrophenol	100027	EPA625	EPA625	ug/L	ND	ND	10	10
71	2-Chloronaphthalene	91587	EPA625	EPA625	ug/L	ND	ND	5	5
78	3,3'-Dichlorobenzidine	91941	EPA625	EPA625	ug/L	ND	ND	5	5
52	4-Chloro-3-methylphenol	59507	EPA625	EPA625	ug/L	ND	ND	1	1
48	4,6-Dinitro-2-methylphenol	534521	EPA625	EPA625	ug/L	ND	ND	5	5
69	4-Bromophenyl phenyl ether	101553	EPA625	EPA625	ug/L	ND	ND	5	5
72	4-Chlorophenyl phenyl ether	7005723	EPA625	EPA625	ug/L	ND	ND	5	5
56	Acenaphthene	83329	EPA625	EPA625	ug/L	ND	ND	1	1
57	Acenaphthylene	208968	EPA625	EPA625	ug/L	ND	ND	5	5
58	Anthracene	120127	EPA625	EPA625	ug/L	ND	ND	5	5
59	Benzidine	92875	EPA625	EPA625	ug/L	ND	ND	5	5
65	Bis(2-chloroethoxy)methane	111911	EPA625	EPA625	ug/L	ND	ND	5	5
66	Bis(2-chloroethyl)ether	111444	EPA625	EPA625	ug/L	ND	ND	1	1
67	Bis(2-chloroisopropyl)ether	39638329	EPA625	EPA625	ug/L	ND	ND	2	2
68	Bis(2-ethylhexyl)phthalate	117817	EPA625	EPA625	ug/L	ND	ND	5	5
70	Butyl Benzyl phthalate	85687	EPA625	EPA625	ug/L	ND	ND	5	5
73	Chrysene	218019	EPA625	EPA625	ug/L	ND	ND	5	5
81	Di-n-butylphthalate	84742	EPA625	EPA625	ug/L	ND	ND	5	5
84	Di-n-octylphthalate	117840	EPA625	EPA625	ug/L	ND	ND	5	5
74	Dibenzo(a,h)-anthracene	53703	EPA625	EPA625	ug/L	ND	ND	10	10
79	Diethyl phthalate	84662	EPA625	EPA625	ug/L	ND	ND	2	2
80	Dimethyl phthalate	131113	EPA625	EPA625	ug/L	ND	ND	2	2

Table 1 - Water Quality Monitoring Results

Northern California Power Agency, Roseville, Placer County

Samples collected July 20, August 2, 3, 10, September 26, and November 16 2006

WATER QUALITY PARAMETER			ANALYTICAL METHOD		RESULTS OF ANALYSIS			QA / QC	
CTR #	Constituent	CAS #	Analytical method used		Results of Analysis			Practical Quantation Limit	
			Influent	Effluent	Units	Influent	Effluent	Influent	Effluent
86	Fluoranthene	206440	EPA625	EPA625	ug/L	ND	ND	1	1
87	Fluorene	86737	EPA625	EPA625	ug/L	ND	ND	5	5
90	Hexachlorocyclopentadiene	77474	EPA625	EPA625	ug/L	ND	ND	10	10
92	Indeno(1,2,3-c,d)pyrene	193395	EPA625	EPA625	ug/L	ND	ND	10	10
93	Isophorone	78591	EPA625	EPA625	ug/L	ND	ND	1	1
98	N-Nitrosodiphenylamine	86306	EPA625	EPA625	ug/L	ND	ND	1	1
96	N-Nitrosodimethylamine	62759	EPA625	EPA625	ug/L	ND	ND	5	5
97	N-Nitrosodi-n-propylamine	621647	EPA625	EPA625	ug/L	ND	ND	5	5
95	Nitrobenzene	98953	EPA625	EPA625	ug/L	ND	ND	1	1
53	Pentachlorophenol	87865	EPA625	EPA625	ug/L	ND	ND	5	5
99	Phenanthrene	85018	EPA625	EPA625	ug/L	ND	ND	5	5
54	Phenol	108952	EPA625	EPA625	ug/L	ND	ND	1	1
100	Pyrene	129000	EPA625	EPA625	ug/L	ND	ND	5	5
Polynuclear Aromatic Hydrocarbons						~~	~~		
60	Benzo(a)anthracene (1,2-Benzanthracene)	56553	EPA625	EPA625	ug/L	ND	ND	10	5
61	Benzo(a)pyrene (3,4-Benzopyrene)	50328	EPA625	EPA625	ug/L	ND	ND	10	10
62	Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205992	EPA625	EPA625	ug/L	ND	ND	10	5
63	Benzo(g,h,I)perylene	191242	EPA625	EPA625	ug/L	ND	ND	5	5
64	Benzo(k)fluoranthene	207089	EPA625	EPA625	ug/L	ND	ND	10	10
Total Metals and Inorganics						~~	~~		
	Aluminum	7429905	3010A / 200.7	3010A / 200.7	mg/L	ND	0.1	0.1	0.1
1	Antimony	7440630	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01	0.01 [a]
2	Arsenic	7440382	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01	0.01
15	Asbestos	1332214	EPA600/80-5	EPA600/80-5	MFL [b]	ND	ND	0.2	0.2
	Barium	7440393	3010A / 200.7	3010A / 200.7	mg/L	0.135	0.133	0.005	0.005
3	Beryllium	7440417	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.005	0.005 [a]
	Boron		3010A / 200.7	3010A / 200.7	mg/L	0.4	0.4	0.2	0.2
4	Cadmium	7440439	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.005	0.005
	Calcium		3010A / 200.7	3010A / 200.7	mg/L	70	70	1	1
5a	Chromium (total)	7440473	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01	0.01
5b	Chromium (VI)	18540299	7196A/3500	7196A/3500	mg/L	ND	ND	0.005	0.005
6	Copper	7440508	3010A / 200.7	APDC/ICP-MS	ug/L	1.52	10.4	0.02	0.02
14	Cyanide	57125	4500CNCE	4500CNCE	mg/L	ND	0.042	0.005	0.005
	Fluoride	7782414	EPA300	EPA300	mg/L	0.6	0.9	0.1	0.1
	Iron	7439896	3010A / 200.7	3010A / 200.7	mg/L	0.23	0.32	0.05	0.05
7	Lead	7439921	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01 [a]	0.01 [a]
	Magnesium		3010A / 200.7	3010A / 200.7	mg/L	29	29	1	1
	Manganese	7439965	3010A / 200.7	3010A / 200.7	mg/L	0.07	0.11	0.01	0.01
8	Mercury	7439976	1631E	1631E	ug/L	0.0028	0.0072	0.0005	0.0005
	Molybdenum		3010A / 200.7		mg/L	0.01		0.01	
9	Nickel	7440020	3010A / 200.7	3010A / 200.7	mg/L	0.08	0.09	0.01	0.01
10	Selenium	7782492	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01	0.01
	Silica		200.7	3010A / 200.7	mg/L	147	0.33	2	2
11	Silver	7440224	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01	0.01
	Sodium		3010A / 200.7	3010A / 200.7	mg/L	184	196	1	1
12	Thallium	7440280	3010A / 200.7	3010A / 200.7	mg/L	ND	ND	0.01	0.01
	Vanadium		3010A / 200.7		mg/L	0.04		0.01	
13	Zinc	7440666	3010A / 200.7	3010A / 200.7	mg/L	0.06	0.07	0.02	0.02
Pesticides and PCBs						~~	~~		
102	Aldrin	309002	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
103	Alpha Hexachlorocyclohexane (BHC)	319846	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
104	Beta Hexacachlorocyclohexane (BHC)	319857	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
105	Lindane (gamma-Hexachlorocyclohexane)	58899	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
106	Delta Hexachlorocyclohexane (BHC)	319868	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
107	Chlordane	57749	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
	alpha-Chlordane		3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
	gamma-Chlordane		3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
108	4,4'-DDT	50293	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
109	4,4'-DDE	72559	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
110	4,4'-DDD	72548	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
111	Dieldrin	60571	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
112	Endosulfan I (alpha-Endosulfan)	959988	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
113	Endosulfan II (beta-Endosulfan)	33213659	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
114	Endosulfan sulfate (Thiodan)	1031078	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
115	Endrin	72208	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
116	Endrin Aldehyde	7421934	3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
	Endrin Ketone		3520C/8081	3520C/8081	ug/L	ND	ND	0.05	0.05
117	Heptachlor	76448	3520C/8081	3520C/8081	ug/L	ND	ND	0.05 [a]	0.05 [a]
118	Heptachlor Epoxide	1024573	3520C/8081	3520C/8081	ug/L	ND	ND	0.05 [a]	0.05 [a]
119	PCB-1016 (/1242)	12674112	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5
120	PCB-1221	11104282	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5
121	PCB-1232	11141165	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5
122	PCB-1242 (/1016)	53469219	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5

Table 1 - Water Quality Monitoring Results

Northern California Power Agency, Roseville, Placer County

Samples collected July 20, August 2, 3, 10, September 26, and November 16 2006

WATER QUALITY PARAMETER			ANALYTICAL METHOD		RESULTS OF ANALYSIS			QA / QC	
CTR #	Constituent	CAS #	Analytical method used		Results of Analysis			Practical Quantation Limit	
			Influent	Effluent	Units	Influent	Effluent	Influent	Effluent
123	PCB-1248	12672296	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5
124	PCB-1254	11097691	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5
125	PCB-1260	11096825	3520C/8082	3520C/8082	ug/L	ND	ND	0.5	0.5
126	Toxaphene (Camphechlor)	8001352	3520C/8082	3520C/8081	ug/L	ND	ND	2	2
	1,2-Dibromo-3-chloropropane (DBCP)	96128	504.1	504.1	ug/L	0.01	ND	0.01	0.01
	2,4,5-TP (Silvex)	93765	EPA515.3	EPA515.3	ug/L	ND	ND	1	1
	2,4-D	94757	EPA515.3	EPA515.3	ug/L	ND	ND	2	2
	Alachlor	15972608	EPA507	EPA507	ug/L	ND	ND	1	1
	Aldicarb (Temik)	116-06-3	EPA531.1	EPA531.1	ug/L	ND	ND	3	3
	Aldicarb Sulfone		EPA531.1	EPA531.1	ug/L	ND	ND	4	4
	Aldicarb Sulfoxide		EPA531.1	EPA531.1	ug/L	ND	ND	3	3
	Atrazine	1912249	EPA507	EPA507	ug/L	ND	ND	0.5	0.5
	Bentazon	25057890	EPA515.3	EPA507	ug/L	ND	ND	2	2
	Carbaryl (Sevin)	63-25-2	EPA531.1	EPA531.1	ug/L	ND	ND	5	5
	Carbofuran	1563662	EPA531.1	EPA531.1	ug/L	ND	ND	5	5
	3-Hydroxycarbofuran	16655826	EPA531.1	EPA531.1	ug/L	ND	ND	3	3
	Dalapon	75990	EPA515.3	EPA515.3	ug/L	ND	ND	10	10
	Di(2-ethylhexyl)adipate [bis(2-ethylhexyl)adipate	103231		EPA525.2	ug/L		ND		1
	Dinoseb	88857	EPA515.3	EPA515.3	ug/L	ND	ND	2	2
	Diquat	85007	EPA549.2	EPA547	ug/L	ND	ND	2	2
	Endothall	145733	EPA548.1	EPA548.1	ug/L	ND	ND	40	40
	Ethylene Dibromide (EDB, 1,2-dibromoethane)	106934	504.1	5030B/8260B	ug/L	ND	ND	0.02	0.02
	Glyphosate (Roundup)	1071836	EPA547	EPA547	ug/L	ND	ND	20	20
	Methomyl (Lannate)	16752-77-5	EPA531.1	EPA531.1	ug/L	ND	ND	2	2
	Methoxychlor (Marlate)	72435	3520C/8081	3520C/8081	ug/L	ND	ND	0.5	0.5
	Molinate (Ordram)	2212671	EPA507	EPA507	ug/L	ND	ND	0.5	0.5
	Oxamyl (Surflan)	23135220	EPA531.1	EPA531.1	ug/L	ND	ND	5	5
	Picloram	1918021	EPA515.3	EPA515.3	ug/L	ND	ND	1	1
	Propachlor (Ramrod)	1918-16-7	EPA507	EPA507	ug/L	ND	ND	1	1
	Simazine (Princep)	122349	EPA507	EPA507	ug/L	ND	ND	0.5	0.5
	Thiobencarb (Bolero)	28249776	EPA507	EPA507	ug/L	ND	ND	0.5	0.5
	Tributyltin	688733	GC/FPD	GC/FPD	ug/L	ND	ND	0.002	0.002
General Minerals						~~	~~		
	pH		EPA150.1	EPA150.1	pH Units	7.9	8.0		
	Alkalinity (as $CaCO_3$)		2320B	2320B	mg/L	310	380	10	10
	Hardness (as $CaCO_3$)		Calculated	Calculated	mg/L	295	294	2.5	2.5
	Bicarbonate		2320B		mg/L	380	460	10	10
	Carbonate		2320B		mg/L	ND	ND	10	10
	Hydroxide		2320B		mg/L	ND	ND	10	10
	Total Disolved Solids (TDS)		2540C	2540C	mg/L	1020	1060	40	40
	Specific conductance (EC)		2510B	2510B	umhos/cm	1440	1510	1	1
	Ammonia (as N)	7664417		4500	mg/L		0.7		0.2
	Nitrate	14797558	EPA300.0	EPA300.0	mg/L	59.8	52.6	0.4	0.4
	Nitrite	14797650	EPA300.0	EPA300.0	mg/L	1.9	34.3	0.3	0.3
	Phosphorus, Total (as P)	7723140	EPA300.0	EPA365.3	mg/L	0.5	1.6	0.1	0.5
	Potassium		3010A / 200.7		mg/L	45		1	
	Chloride	16887006	EPA300.0	EPA300.0	mg/L	158	171	5	5
	Sulfate		EPA300.0	EPA300.0	mg/L	97	122	1	1
	Sulfide (total)		4500-S	4500-S	mg/L	ND	ND	0.1	0.1
	Sulfite		4500-SO3	4500-SO3	mg/L	ND	ND	2	2
	Foaming Agents (MBAS)			SM5540C	mg/L	ND	ND	0.1	0.1
	Total Suspended Solids (TSS)		2540D		mg/L	ND		10	
	Biochemical Oxygen Demand (BOD)		5210B	5210B	mg/L	2.9	77 [c]	2	32
	Chemical Oxygen Demand (COD)		5220	5220	mg/L	ND	50	20	20
	Chlorine, free available		4500Cl	4500Cl	mg/L	ND	ND	0.1	0.1
Dioxins and Furans						~~	~~		
	2,3,7,8TetraCDD		EPA1613B	EPA1613B	pg/L	ND	ND	3	3.8
Organophosphorus Pesticides						~~	~~		
	Bromacil		EPA507	EPA507	ug/L	ND	ND	2	2
	Butachlor		EPA507	EPA507	ug/L	ND	ND	1	1
	Chlorpyrifos (Dursban)	2921882	3520C/8141A	3520C/8141A	ug/L	ND	ND	2	2
	Diazinon	33415	EPA507	EPA507	ug/L	ND	ND	2	2
	Dimethoate		EPA507	EPA507	ug/L	ND	ND	2	2
	Metolachlor		EPA507	EPA507	ug/L	ND	ND	1	1
	Metribuzin		EPA507	EPA507	ug/L	ND	ND	0.5	0.5
	Prometryn (Caparol)		EPA507	EPA507	ug/L	ND	ND	2	2
Chlorinated Acids						~~	~~		
	Dicamba		EPA515.3	EPA525.3	ug/L	ND	ND	1	1
Miscellaneous Volatile and Semi-Volatile Organic Compounds						~~	~~		
	1,2,3,-Trichlorobenzene			5030B/8260B	ug/L		ND		1
	1,2,3-Trichloropropane			5030B/8260B	ug/L		ND		1
	1,2,4-Trimethylbenzene			5030B/8260B	ug/L		ND		1
	1,2-Dibromo-3-chloropropane			5030B/8260B	ug/L		ND		1

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Northern California Power Agency, Roseville, Placer County

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WATER QUALITY PARAMETER			ANALYTICAL METHOD		RESULTS OF ANALYSIS			QA / QC	
CTR #	Constituent	CAS #	Analytical method used		Results of Analysis			Practical Quantation Limit	
			Influent	Effluent	Units	Influent	Effluent	Influent	Effluent
	1,3,5-Trimethylbenzene			5030B/8260B	ug/L		ND		1
	1,4-Dioxane			5030B/8260B	ug/L		ND		200
	2,2-Dichloropropane			5030B/8260B	ug/L		ND		1
	2-Butanone (MEK)		EPA624	5030B/8260B	ug/L	ND	ND	5	10
	2-Chlorotoulene			5030B/8260B	ug/L		ND		1
	4-Chlorotoulene			5030B/8260B	ug/L		ND		1
	2-Hexanone		EPA624	5030B/8260B	ug/L	ND	ND	5	10
	4-Methyl-2-petanone (MIBK)		EPA624	5030B/8260B	ug/L	ND	ND	5	10
	Methyl-tert-butyl ether (MTBE)	1634044	EPA624	5030B/8260B	ug/L	ND	ND	0.5	2
	Trichlorofluoromethane	75694	EPA624	5030B/8260B	ug/L	ND	ND	1	1
	1,1,2-Trichloro-1,2,2-Trifluoroethane	76131		5030B/8260B	ug/L		ND		1
	Acetone		EPA624	5030B/8260B	ug/L	40	10	20	10
	Bromobenzene			5030B/8260B	ug/L		ND		1
	Bromochloromethane			5030B/8260B	ug/L		ND		1
	Carbon disulfide		EPA624	5030B/8260B	ug/L	7	ND	5	1
	Dibromomethane			5030B/8260B	ug/L		ND		1
	Dichlorodifluoromethane			5030B/8260B	ug/L		ND		1
	Di-isopropyl ether (DIPE)			5030B/8260B	ug/L		ND		2
	Ethyl tert-butyl ether (ETBE)			5030B/8260B	ug/L		ND		2
	tert-Butanol	75650		5030B/8260B	ug/L		ND		20
	Isopropylbenzene			5030B/8260B	ug/L		ND		1
	n-Butylbenzene			5030B/8260B	ug/L		ND		1
	sec-Butylbenzene			5030B/8260B	ug/L		ND		1
	tert-Butylbenzene			5030B/8260B	ug/L		ND		1
	n-Propylbenzene			5030B/8260B	ug/L		ND		1
	p-Isopropyltoluene			5030B/8260B	ug/L		ND		1
	Pyridine		EPA3520C/625		ug/L	ND		10	
	tert-Amyl methyl ether (TAME)			5030B/8260B	ug/L		ND		2
	Vinyl acetate		EPA624	5030B/8260B	ug/L	ND	ND	20	10
	Styrene	100425	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1
	Xylenes	1330207	EPA624	5030B/8260B	ug/L	ND	ND	0.5	1

Notes

a PQL is greater than that recommended by Regional Board Five, December 2001 revised 13267 List

b MFL - millions of fibers per liter

c PQL adjusted up for dilution

APPENDIX 7

Water Chemistry Evaluation of the Existing STIG-1 and Proposed LEC-1 Injection Wells

Water Chemistry Evaluation of the Existing STIG-1 and Proposed LEC-1 Injection Wells

PREPARED FOR: Toni Pezzetti/SAC

PREPARED BY: Brian Schroth, PhD/SAC

DATE: August 22, 2008

Summary of Water Chemistry and Geochemical Modeling

Groundwater from the Domengine aquifer had a total dissolved solids (TDS) concentration of 14,066 mg/L prior to injection at well STIG-1. This is well above the EPA Secondary MCL for drinking water (500 mg/L), and is considered a brackish water. It is dominated by sodium and chloride, and the presence of modest concentrations of nitrate indicate that the aquifer is under chemically oxidizing conditions. Water injected at STIG-1 over the last 5 years has had a TDS range between about 500 and 800 mg/L with a sodium-bicarbonate chemistry. Injection of this water has served to dilute the salinity of the aquifer.

The water that is proposed for injection at well LEC-1 and LEC-2, if it is drilled, is a sodium-chloride water with a TDS of 2,187 mg/L, more similar to the aquifer chemistry than the STIG-1 injection water, but still about one-seventh of the aquifer TDS. However, concentrations of sulfate, nitrate, and phosphate are much higher than aquifer concentrations and, in the cases of sulfate and nitrate, significantly higher than those in the current injection water for STIG-1 (there are no data available for phosphate concentrations in the STIG-1 water).

The USGS geochemical software PHREEQC (Parkhurst and Appelo 1999) was used to simulate mixing of both injection waters with the ambient Domengine aquifer water. The PHREEQC software evaluates water chemistry of each water to be mixed and simulates the effects of mixing waters at user-selected ratios. The program's thermodynamic database is used to calculate concentrations of aqueous species and saturation indices of possible mineral precipitates, providing an assessment of potential well clogging from these precipitates. A water in equilibrium with a given solid mineral phase is defined as "saturated" with respect to that mineral, and the saturation index (SI) is around zero (plus or minus about 0.5). Undersaturation (negative SI value) indicates that the mineral is not thermodynamically favored to precipitate and oversaturation (positive SI value) indicates precipitation is favored. Available water chemistry data were used for aquifer and injection waters. Temperature assignments were based on downhole temperature survey data and measurements on current injectate.

Thermodynamic analysis of Domengine formation water from May 15, 1993 showed that the water is in approximate equilibrium with calcite and dolomite, common carbonate mineral phases in aquifer matrix material. Amorphous silica, the most common precipitate of dissolved silica that forms around well screens, is undersaturated in the formation, meaning it is not favored to precipitate.

Analysis of the STIG-1 injection water chemistry for a sample collected February 22, 2005 showed saturation with respect to calcite, dolomite, and amorphous silica. This sample was deliberately chosen for its high dissolved silica concentration (92 mg/L) relative to other samples over the past 5 years. It is assumed that on average the injection water has been lower in dissolved silica. The analysis also showed oversaturation with respect to the magnesium silicate mineral talc. Many silicate minerals can show oversaturation, but often are not oberved due to very slow kinetics of formation. Talc is an example of a mineral that could form in a short time frame if the temperature becomes elevated. At the assumed temperatures of injection at STIG-1, however, this is not assumed to be likely.

The proposed injection water chemistry shows similar mineral saturation to the STIG-1 water chemistry, discussed above. Silica concentration is lower than the average STIG-1 injection water, and amorphous silica and other silicate minerals are even less likely to precipitate, according to PHREEQC calculations.

Mixing of Domengine formation water with STIG-1 injection water was simulated at ratios of 3:1 (formation water to injection water) and 1:1. Although the injected water has higher concentrations of sulfate, silica, and (on average) nitrate, these concentrations have not been high enough to cause mineral precipitation at the well screen, according to model simulations. The STIG-1 injection water was nearly saturated (at equilibrium) with respect to amorphous silica, but mixing with formation water only served to dilute the silica. These simulations reflect agreement with observed conditions over the past several years of injection, which have exhibited no suggestion of mineral incrustation or associated loss of production. PHREEQC output results are provided in Table 1.

In a second set of simulations, mixing of the same Domengine formation water from May 15, 1993 with the proposed LEC-1/LEC-2 injection water chemistry was simulated in the same manner as with the STIG-1 water (PHREEQC output file shown in Table 2). Under the assumed conditions of the simulation, no precipitates were favored to form. However, it should be noted that proposed concentration of nitrate (253.7 mg/L) is very high, far above the primary MCL for nitrate (45 mg/L). Such high concentrations may stimulate the growth of nitrate-reducing bacteria in and around the well screen if organic carbon is also increased. It is probable that if no significant increase in organic carbon is made to the aquifer, the extra nitrate will simply remain dissolved in the injected water. There is no predicted estimate of organic carbon in the blowdown water, so there is no way to accurately predict this. It is recommended to maintain dissolved silica concentrations as low as possible, along with temperature, as silicate minerals are more likely to precipitate at elevated temperature.

Reference

Parkhurst, D.L. and C.A.J. Appelo, 1999, "User's Guide to PHREEQC (Version 2)-A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations," *U.S. Geological Survey Water-Resources Investigations Report 99-4259*, 312 p. Document and compiled program available at the website: http://wwwbrr.cr.usgs.gov/projects/GWC_coupled/phreeqc/index.html

Table 1. PHREEQC output file for simulation of mixing between Domengine formation water and STIG-1 injection water.

```
   Input file: C:\Documents and Settings\bschroth\My
Documents\Documents\NCPA_Lodi\NCPA_Well#1_Donengine.pqi
  Output file: C:\Documents and Settings\bschroth\My
Documents\Documents\NCPA_Lodi\NCPA_Well#1_Donengine.pqo
Database file: C:\Program Files\USGS\Phreeqc Interactive
2.14.3\phreeqc.dat

------------------
Reading data base.
------------------

      SOLUTION_MASTER_SPECIES
      SOLUTION_SPECIES
      PHASES
      EXCHANGE_MASTER_SPECIES
      EXCHANGE_SPECIES
      SURFACE_MASTER_SPECIES
      SURFACE_SPECIES
      RATES
      END
-------------------------------------
Reading input data for simulation 1.
-------------------------------------

      DATABASE C:\Program Files\USGS\Phreeqc Interactive
2.14.3\phreeqc.dat
      TITLE  NCPA Injection Well in Lodi: simulation of mixing with
Domengine Aquifer
      SOLUTION 1 Domengine Formation Water May 1993
      Temp  35
      pH    7.85
      pe    10
      redox pe
      units mg/l
      density     1
      Na    3200
      K     46
      Ca    761
      Mg    86
      Cl    7000
      Alkalinity  50.81 as Ca0.5(CO3)0.5
      S(6)  8     as SO4
      N(5)  14    as NO3
      Si    16.5  as SiO2
          water    1 # kg
      END
-----
TITLE
-----

  NCPA Injection Well in Lodi: simulation of mixing with Domengine Aquifer

-------------------------------------------
Beginning of initial solution calculations.
```

```
-------------------------------------------

Initial solution 1.     Domengine Formation Water May 1993

-----------------------------Solution composition------------------------
-----

      Elements           Molality       Moles

      Alkalinity       1.027e-003  1.027e-003
      Ca               1.920e-002  1.920e-002
      Cl               1.997e-001  1.997e-001
      K                1.190e-003  1.190e-003
      Mg               3.577e-003  3.577e-003
      N(5)             2.283e-004  2.283e-004
      Na               1.408e-001  1.408e-001
      S(6)             8.422e-005  8.422e-005
      Si               2.777e-004  2.777e-004

----------------------------Description of solution-----------------------
-----

                                        pH  =   7.850
                                        pe  =  10.000
                        Activity of water  =   0.994
                           Ionic strength  =  2.168e-001
                       Mass of water (kg)  =  1.000e+000
                    Total carbon (mol/kg)  =  9.855e-004
                       Total CO2 (mol/kg)  =  9.855e-004
                      Temperature (deg C)  =  35.000
                  Electrical balance (eq)  = -1.359e-002
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -3.50
                                Iterations  =   6
                                   Total H  = 1.110145e+002
                                   Total O  = 5.551129e+001

----------------------------Distribution of species-----------------------
-----

                                                      Log       Log
Log
   Species                  Molality    Activity  Molality  Activity
Gamma

   OH-                    2.074e-006  1.445e-006    -5.683    -5.840    -
0.157
   H+                     1.784e-008  1.413e-008    -7.749    -7.850    -
0.101
   H2O                    5.551e+001  9.938e-001     1.744    -0.003
0.000
C(4)            9.855e-004
   HCO3-                  8.068e-004  5.954e-004    -3.093    -3.225    -
0.132
   CaHCO3+                6.865e-005  5.066e-005    -4.163    -4.295    -
0.132
   NaHCO3                 3.298e-005  3.467e-005    -4.482    -4.460
0.022
```

```
   CaCO3                  2.801e-005  2.944e-005    -4.553    -4.531
0.022
   CO2                    1.644e-005  1.729e-005    -4.784    -4.762
0.022
   MgHCO3+                1.171e-005  8.663e-006    -4.931    -5.062    -
0.131
   NaCO3-                 1.001e-005  7.406e-006    -4.999    -5.130    -
0.131
   CO3-2                  7.950e-006  2.358e-006    -5.100    -5.627    -
0.528
   MgCO3                  2.939e-006  3.090e-006    -5.532    -5.510
0.022
Ca              1.920e-002
   Ca+2                   1.909e-002  5.894e-003    -1.719    -2.230    -
0.510
   CaHCO3+                6.865e-005  5.066e-005    -4.163    -4.295    -
0.132
   CaCO3                  2.801e-005  2.944e-005    -4.553    -4.531
0.022
   CaSO4                  1.747e-005  1.836e-005    -4.758    -4.736
0.022
   CaOH+                  9.304e-008  6.881e-008    -7.031    -7.162    -
0.131
   CaHSO4+                2.354e-012  1.741e-012   -11.628   -11.759    -
0.131
Cl              1.997e-001
   Cl-                    1.997e-001  1.401e-001    -0.700    -0.853    -
0.154
H(0)            2.441e-039
   H2                     1.220e-039  1.283e-039   -38.914   -38.892
0.022
K               1.190e-003
   K+                     1.190e-003  8.349e-004    -2.925    -3.078    -
0.154
   KSO4-                  1.339e-007  9.907e-008    -6.873    -7.004    -
0.131
   KOH                    1.938e-010  2.037e-010    -9.713    -9.691
0.022
Mg              3.577e-003
   Mg+2                   3.557e-003  1.178e-003    -2.449    -2.929    -
0.480
   MgHCO3+                1.171e-005  8.663e-006    -4.931    -5.062    -
0.131
   MgSO4                  4.806e-006  5.052e-006    -5.318    -5.297
0.022
   MgCO3                  2.939e-006  3.090e-006    -5.532    -5.510
0.022
   MgOH+                  9.745e-007  7.207e-007    -6.011    -6.142    -
0.131
N(5)            2.283e-004
   NO3-                   2.283e-004  1.561e-004    -3.641    -3.807    -
0.165
Na              1.408e-001
   Na+                    1.407e-001  1.035e-001    -0.852    -0.985    -
0.133
   NaHCO3                 3.298e-005  3.467e-005    -4.482    -4.460
0.022
```

```
   NaSO4-                1.064e-005  7.869e-006    -4.973    -5.104    -
0.131
   NaCO3-                1.001e-005  7.406e-006    -4.999    -5.130    -
0.131
   NaOH                  4.578e-008  4.812e-008    -7.339    -7.318
0.022
O(0)            6.311e-012
   O2                    3.156e-012  3.317e-012   -11.501   -11.479
0.022
S(6)            8.422e-005
   SO4-2                 5.117e-005  1.426e-005    -4.291    -4.846    -
0.555
   CaSO4                 1.747e-005  1.836e-005    -4.758    -4.736
0.022
   NaSO4-                1.064e-005  7.869e-006    -4.973    -5.104    -
0.131
   MgSO4                 4.806e-006  5.052e-006    -5.318    -5.297
0.022
   KSO4-                 1.339e-007  9.907e-008    -6.873    -7.004    -
0.131
   HSO4-                 3.322e-011  2.457e-011   -10.479   -10.610    -
0.131
   CaHSO4+               2.354e-012  1.741e-012   -11.628   -11.759    -
0.131
Si              2.777e-004
   H4SiO4                2.721e-004  2.861e-004    -3.565    -3.544
0.022
   H3SiO4-               5.595e-006  4.138e-006    -5.252    -5.383    -
0.131
   H2SiO4-2              1.230e-010  3.681e-011    -9.910   -10.434    -
0.524

------------------------------Saturation indices--------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -2.66   -7.08   -4.42  CaSO4
      Aragonite         0.55   -7.86   -8.41  CaCO3
      Calcite           0.69   -7.86   -8.54  CaCO3
      Chalcedony       -0.10   -3.54   -3.44  SiO2
      Chrysotile        0.22   31.22   31.00  Mg3Si2O5(OH)4
      CO2(g)           -3.19   -4.76   -1.58  CO2
      Dolomite          0.90  -16.41  -17.31  CaMg(CO3)2
      Gypsum           -2.49   -7.08   -4.59  CaSO4:2H2O
      H2(g)           -35.70  -38.89   -3.19  H2
      H2O(g)           -1.26   -0.00    1.26  H2O
      Halite           -3.44   -1.84    1.60  NaCl
      O2(g)            -8.52  -11.48   -2.96  O2
      Quartz            0.30   -3.54   -3.84  SiO2
      Sepiolite        -0.59   14.91   15.51  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -3.75   14.91   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.91   -3.54   -2.63  SiO2
      Talc              3.85   24.15   20.30  Mg3Si4O10(OH)2

------------------
End of simulation.
```

```
------------------

------------------------------------
Reading input data for simulation 2.
------------------------------------

      SOLUTION 2 Well 1 Q1 2005
      Temp  25
      pH    7.6
      pe    10
      redox pe
      units mg/l
      density     1
      Na    147
      K     22
      Ca    43
      Mg    20
      Cl    132
      Alkalinity  220   as Ca0.5(CO3)0.5
      S(6)  76    as SO4
      N(5)  74.4  as NO3
      F     0.3
      Si    92    as SiO2
      END
-------------------------------------------
Beginning of initial solution calculations.
-------------------------------------------

Initial solution 2.     Well 1 Q1 2005

-----------------------------Solution composition-------------------------
-----

      Elements           Molality       Moles

      Alkalinity       4.400e-003  4.400e-003
      Ca               1.074e-003  1.074e-003
      Cl               3.726e-003  3.726e-003
      F                1.580e-005  1.580e-005
      K                5.631e-004  5.631e-004
      Mg               8.233e-004  8.233e-004
      N(5)             1.201e-003  1.201e-003
      Na               6.399e-003  6.399e-003
      S(6)             7.918e-004  7.918e-004
      Si               1.532e-003  1.532e-003

----------------------------Description of solution-----------------------
-----

                                        pH  =   7.600
                                        pe  =  10.000
                         Activity of water  =   1.000
                            Ionic strength  =  1.294e-002
                       Mass of water (kg)   =  1.000e+000
                    Total carbon (mol/kg)   =  4.582e-003
                       Total CO2 (mol/kg)   =  4.582e-003
                     Temperature (deg C)    =  25.000
```

```
                  Electrical balance (eq)  = -1.696e-004
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -0.81
                                Iterations  =   6
                                   Total H  = 1.110229e+002
                                   Total O  = 5.553265e+001

----------------------------Distribution of species-----------------------
-----

                                                     Log       Log
Log
   Species                  Molality    Activity  Molality  Activity
Gamma

   OH-                   4.483e-007  3.984e-007    -6.348    -6.400    -
0.051
   H+                    2.776e-008  2.512e-008    -7.557    -7.600    -
0.043
   H2O                   5.551e+001  9.997e-001     1.744    -0.000
0.000
C(4)             4.582e-003
   HCO3-                 4.273e-003  3.824e-003    -2.369    -2.417    -
0.048
   CO2                   2.154e-004  2.160e-004    -3.667    -3.665
0.001
   CaHCO3+               3.419e-005  3.060e-005    -4.466    -4.514    -
0.048
   MgHCO3+               2.423e-005  2.159e-005    -4.616    -4.666    -
0.050
   NaHCO3                1.219e-005  1.223e-005    -4.914    -4.913
0.001
   CO3-2                 1.113e-005  7.139e-006    -4.953    -5.146    -
0.193
   CaCO3                 7.499e-006  7.522e-006    -5.125    -5.124
0.001
   MgCO3                 3.278e-006  3.288e-006    -5.484    -5.483
0.001
   NaCO3-                8.484e-007  7.560e-007    -6.071    -6.121    -
0.050
Ca               1.074e-003
   Ca+2                  9.784e-004  6.271e-004    -3.009    -3.203    -
0.193
   CaSO4                 5.360e-005  5.376e-005    -4.271    -4.270
0.001
   CaHCO3+               3.419e-005  3.060e-005    -4.466    -4.514    -
0.048
   CaCO3                 7.499e-006  7.522e-006    -5.125    -5.124
0.001
   CaF+                  8.276e-008  7.375e-008    -7.082    -7.132    -
0.050
   CaOH+                 4.648e-009  4.142e-009    -8.333    -8.383    -
0.050
   CaHSO4+               8.877e-012  7.911e-012   -11.052   -11.102    -
0.050
Cl               3.726e-003
   Cl-                   3.726e-003  3.313e-003    -2.429    -2.480    -
0.051
```

```
F                1.580e-005
   F-                    1.519e-005  1.350e-005    -4.818    -4.870    -
0.051
   MgF+                  4.831e-007  4.305e-007    -6.316    -6.366    -
0.050
   CaF+                  8.276e-008  7.375e-008    -7.082    -7.132    -
0.050
   NaF                   4.406e-008  4.419e-008    -7.356    -7.355
0.001
   HF                    5.072e-010  5.087e-010    -9.295    -9.294
0.001
   HF2-                  2.957e-014  2.635e-014   -13.529   -13.579    -
0.050
   SiF6-2                8.853e-033  5.584e-033   -32.053   -32.253    -
0.200
H(0)             8.907e-039
   H2                    4.454e-039  4.467e-039   -38.351   -38.350
0.001
K                5.631e-004
   K+                    5.614e-004  4.992e-004    -3.251    -3.302    -
0.051
   KSO4-                 1.691e-006  1.507e-006    -5.772    -5.822    -
0.050
   KOH                   6.867e-011  6.888e-011   -10.163   -10.162
0.001
Mg               8.233e-004
   Mg+2                  7.468e-004  4.826e-004    -3.127    -3.316    -
0.190
   MgSO4                 4.845e-005  4.860e-005    -4.315    -4.313
0.001
   MgHCO3+               2.423e-005  2.159e-005    -4.616    -4.666    -
0.050
   MgCO3                 3.278e-006  3.288e-006    -5.484    -5.483
0.001
   MgF+                  4.831e-007  4.305e-007    -6.316    -6.366    -
0.050
   MgOH+                 7.824e-008  6.973e-008    -7.107    -7.157    -
0.050
N(5)             1.201e-003
   NO3-                  1.201e-003  1.065e-003    -2.921    -2.973    -
0.052
Na               6.399e-003
   Na+                   6.373e-003  5.687e-003    -2.196    -2.245    -
0.049
   NaSO4-                1.374e-005  1.224e-005    -4.862    -4.912    -
0.050
   NaHCO3                1.219e-005  1.223e-005    -4.914    -4.913
0.001
   NaCO3-                8.484e-007  7.560e-007    -6.071    -6.121    -
0.050
   NaF                   4.406e-008  4.419e-008    -7.356    -7.355
0.001
   NaOH                  1.491e-009  1.495e-009    -8.827    -8.825
0.001
O(0)             4.163e-016
   O2                    2.082e-016  2.088e-016   -15.682   -15.680
0.001
```

```
S(6)            7.918e-004
   SO4-2                6.743e-004  4.296e-004    -3.171    -3.367    -
0.196
   CaSO4                5.360e-005  5.376e-005    -4.271    -4.270
0.001
   MgSO4                4.845e-005  4.860e-005    -4.315    -4.313
0.001
   NaSO4-               1.374e-005  1.224e-005    -4.862    -4.912    -
0.050
   KSO4-                1.691e-006  1.507e-006    -5.772    -5.822    -
0.050
   HSO4-                1.177e-009  1.049e-009    -8.929    -8.979    -
0.050
   CaHSO4+              8.877e-012  7.911e-012   -11.052   -11.102    -
0.050
Si              1.532e-003
   H4SiO4               1.522e-003  1.527e-003    -2.817    -2.816
0.001
   H3SiO4-              1.006e-005  8.963e-006    -4.997    -5.048    -
0.050
   H2SiO4-2             3.848e-011  2.427e-011   -10.415   -10.615    -
0.200
   SiF6-2               8.853e-033  5.584e-033   -32.053   -32.253    -
0.200

------------------------------Saturation indices--------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -2.21   -6.57   -4.36  CaSO4
      Aragonite        -0.01   -8.35   -8.34  CaCO3
      Calcite           0.13   -8.35   -8.48  CaCO3
      Chalcedony        0.74   -2.82   -3.55  SiO2
      Chrysotile       -2.18   30.02   32.20  Mg3Si2O5(OH)4
      CO2(g)           -2.20   -3.67   -1.47  CO2
      Dolomite          0.28  -16.81  -17.09  CaMg(CO3)2
      Fluorite         -2.34  -12.94  -10.60  CaF2
      Gypsum           -1.99   -6.57   -4.58  CaSO4:2H2O
      H2(g)           -35.20  -38.35   -3.15  H2
      H2O(g)           -1.51   -0.00    1.51  H2O
      Halite           -6.31   -4.72    1.58  NaCl
      O2(g)           -12.79  -15.68   -2.89  O2
      Quartz            1.16   -2.82   -3.98  SiO2
      Sepiolite        -0.44   15.32   15.76  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -3.34   15.32   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.10   -2.82   -2.71  SiO2
      Talc              2.99   24.39   21.40  Mg3Si4O10(OH)2

------------------
End of simulation.
------------------

------------------------------------
Reading input data for simulation 3.
------------------------------------
```

```
      MIX 1
          1    0.75
          2    0.25
      END
-----------------------------------------
Beginning of batch-reaction calculations.
-----------------------------------------

Reaction step 1.

Using mix 1.

Mixture 1.

       7.500e-001 Solution 1  Domengine Formation Water May 1993
       2.500e-001 Solution 2  Well 1 Q1 2005

-----------------------------Solution composition------------------------
-----

      Elements           Molality       Moles

      C                1.885e-003  1.885e-003
      Ca               1.467e-002  1.467e-002
      Cl               1.507e-001  1.507e-001
      F                3.951e-006  3.951e-006
      K                1.033e-003  1.033e-003
      Mg               2.889e-003  2.889e-003
      N                4.715e-004  4.715e-004
      Na               1.072e-001  1.072e-001
      S                2.611e-004  2.611e-004
      Si               5.914e-004  5.914e-004

----------------------------Description of solution-----------------------
-----

                                       pH  =   7.588      Charge balance
                                       pe  =  11.227      Adjusted to
redox equilibrium
                        Activity of water  =   0.995
                           Ionic strength  =  1.656e-001
                       Mass of water (kg)  =  1.000e+000
                  Total alkalinity (eq/kg)  =  1.870e-003
                       Total CO2 (mol/kg)  =  1.885e-003
                      Temperature (deg C)  =  32.500
                   Electrical balance (eq)  = -1.023e-002
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -3.46
                                Iterations  =  11
                                   Total H  = 1.110166e+002
                                   Total O  = 5.551663e+001

----------------------------Distribution of species-----------------------
-----

                                                      Log       Log
Log
```

```
   Species                  Molality    Activity  Molality  Activity
Gamma

   OH-                   9.259e-007  6.663e-007    -6.033    -6.176    -
0.143
   H+                    3.213e-008  2.581e-008    -7.493    -7.588    -
0.095
   H2O                   5.551e+001  9.953e-001     1.744    -0.002
0.000
C(-4)            0.000e+000
   CH4                   0.000e+000  0.000e+000  -131.331  -131.315
0.017
C(4)             1.885e-003
   HCO3-                 1.599e-003  1.208e-003    -2.796    -2.918    -
0.122
   CaHCO3+               1.090e-004  8.236e-005    -3.962    -4.084    -
0.122
   CO2                   6.279e-005  6.523e-005    -4.202    -4.186
0.017
   NaHCO3                5.261e-005  5.465e-005    -4.279    -4.262
0.017
   CaCO3                 2.335e-005  2.426e-005    -4.632    -4.615
0.017
   MgHCO3+               1.976e-005  1.486e-005    -4.704    -4.828    -
0.124
   CO3-2                 7.730e-006  2.517e-006    -5.112    -5.599    -
0.487
   NaCO3-                7.250e-006  5.454e-006    -5.140    -5.263    -
0.124
   MgCO3                 2.623e-006  2.725e-006    -5.581    -5.565
0.017
Ca               1.467e-002
   Ca+2                  1.449e-002  4.846e-003    -1.839    -2.315    -
0.476
   CaHCO3+               1.090e-004  8.236e-005    -3.962    -4.084    -
0.122
   CaSO4                 5.129e-005  5.329e-005    -4.290    -4.273
0.017
   CaCO3                 2.335e-005  2.426e-005    -4.632    -4.615
0.017
   CaF+                  1.641e-007  1.234e-007    -6.785    -6.909    -
0.124
   CaOH+                 4.123e-008  3.102e-008    -7.385    -7.508    -
0.124
   CaHSO4+               1.184e-011  8.905e-012   -10.927   -11.050    -
0.124
Cl               1.507e-001
   Cl-                   1.507e-001  1.091e-001    -0.822    -0.962    -
0.140
F                3.951e-006
   F-                    3.427e-006  2.466e-006    -5.465    -5.608    -
0.143
   MgF+                  2.500e-007  1.881e-007    -6.602    -6.726    -
0.124
   CaF+                  1.641e-007  1.234e-007    -6.785    -6.909    -
0.124
```

```
   NaF                    1.099e-007  1.141e-007    -6.959    -6.943
0.017
   HF                     1.054e-010  1.095e-010    -9.977    -9.961
0.017
   HF2-                   1.449e-015  1.090e-015   -14.839   -14.962    -
0.124
   SiF6-2                 1.491e-037  4.773e-038   -36.827   -37.321    -
0.495
H(0)             0.000e+000
   H2                     0.000e+000  0.000e+000   -40.828   -40.811
0.017
K                1.033e-003
   K+                     1.033e-003  7.473e-004    -2.986    -3.126    -
0.140
   KSO4-                  4.082e-007  3.071e-007    -6.389    -6.513    -
0.124
   KOH                    9.619e-011  9.993e-011   -10.017   -10.000
0.017
Mg               2.889e-003
   Mg+2                   2.852e-003  1.011e-003    -2.545    -2.995    -
0.450
   MgHCO3+                1.976e-005  1.486e-005    -4.704    -4.828    -
0.124
   MgSO4                  1.418e-005  1.473e-005    -4.848    -4.832
0.017
   MgCO3                  2.623e-006  2.725e-006    -5.581    -5.565
0.017
   MgOH+                  3.643e-007  2.741e-007    -6.439    -6.562    -
0.124
   MgF+                   2.500e-007  1.881e-007    -6.602    -6.726    -
0.124
N(-3)            0.000e+000
   NH4+                   0.000e+000  0.000e+000   -53.295   -53.452    -
0.157
   NH3                    0.000e+000  0.000e+000   -54.901   -54.884
0.017
   NH4SO4-                0.000e+000  0.000e+000   -56.507   -56.631    -
0.124
N(0)             3.060e-009
   N2                     1.530e-009  1.589e-009    -8.815    -8.799
0.017
N(3)             6.743e-014
   NO2-                   6.743e-014  4.776e-014   -13.171   -13.321    -
0.150
N(5)             4.715e-004
   NO3-                   4.715e-004  3.340e-004    -3.327    -3.476    -
0.150
Na               1.072e-001
   Na+                    1.071e-001  8.044e-002    -0.970    -1.095    -
0.124
   NaHCO3                 5.261e-005  5.465e-005    -4.279    -4.262
0.017
   NaSO4-                 2.889e-005  2.173e-005    -4.539    -4.663    -
0.124
   NaCO3-                 7.250e-006  5.454e-006    -5.140    -5.263    -
0.124
```

```
   NaF                    1.099e-007  1.141e-007    -6.959    -6.943
0.017
   NaOH                   1.973e-008  2.049e-008    -7.705    -7.688
0.017
O(0)            7.655e-009
   O2                     3.827e-009  3.976e-009    -8.417    -8.401
0.017
S(-2)           0.000e+000
   HS-                    0.000e+000  0.000e+000  -129.676  -129.819    -
0.143
   H2S                    0.000e+000  0.000e+000  -130.573  -130.556
0.017
   S-2                    0.000e+000  0.000e+000  -134.428  -134.931    -
0.503
S(6)            2.611e-004
   SO4-2                  1.663e-004  5.147e-005    -3.779    -4.288    -
0.509
   CaSO4                  5.129e-005  5.329e-005    -4.290    -4.273
0.017
   NaSO4-                 2.889e-005  2.173e-005    -4.539    -4.663    -
0.124
   MgSO4                  1.418e-005  1.473e-005    -4.848    -4.832
0.017
   KSO4-                  4.082e-007  3.071e-007    -6.389    -6.513    -
0.124
   HSO4-                  2.032e-010  1.528e-010    -9.692    -9.816    -
0.124
   CaHSO4+                1.184e-011  8.905e-012   -10.927   -11.050    -
0.124
   NH4SO4-                0.000e+000  0.000e+000   -56.507   -56.631    -
0.124
Si              5.914e-004
   H4SiO4                 5.855e-004  6.082e-004    -3.232    -3.216
0.017
   H3SiO4-                5.923e-006  4.456e-006    -5.227    -5.351    -
0.124
   H2SiO4-2               5.850e-011  1.873e-011   -10.233   -10.727    -
0.495
   SiF6-2                 1.491e-037  4.773e-038   -36.827   -37.321    -
0.495

-----------------------------Saturation indices-------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -2.20   -6.60   -4.40  CaSO4
      Aragonite         0.47   -7.91   -8.39  CaCO3
      Calcite           0.61   -7.91   -8.53  CaCO3
      CH4(g)         -128.39 -131.31   -2.92  CH4
      Chalcedony        0.25   -3.21   -3.47  SiO2
      Chrysotile       -1.18   30.11   31.29  Mg3Si2O5(OH)4
      CO2(g)           -2.63   -4.19   -1.55  CO2
      Dolomite          0.75  -16.51  -17.26  CaMg(CO3)2
      Fluorite         -3.01  -13.53  -10.52  CaF2
      Gypsum           -2.02   -6.61   -4.59  CaSO4:2H2O
      H2(g)           -37.63  -40.81   -3.18  H2
```

```
      H2O(g)           -1.32   -0.00    1.32  H2O
      H2S(g)         -129.48 -130.56   -1.08  H2S
      Halite           -3.66   -2.06    1.60  NaCl
      N2(g)            -5.51   -8.80   -3.28  N2
      NH3(g)          -56.51  -54.88    1.62  NH3
      O2(g)            -5.46   -8.40   -2.94  O2
      Quartz            0.66   -3.21   -3.87  SiO2
      Sepiolite        -0.85   14.72   15.57  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -3.94   14.72   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.56   -3.21   -2.65  SiO2
      Sulfur          -97.64  -92.93    4.71  S
      Talc              3.12   23.69   20.57  Mg3Si4O10(OH)2

------------------
End of simulation.
------------------

-------------------------------------
Reading input data for simulation 4.
-------------------------------------

      MIX 2
          1    0.5
          2    0.5
      END
----------------------------------------
Beginning of batch-reaction calculations.
----------------------------------------

Reaction step 1.

Using mix 2.

Mixture 2.

       5.000e-001 Solution 1  Domengine Formation Water May 1993
       5.000e-001 Solution 2  Well 1 Q1 2005

-----------------------------Solution composition-------------------------
-----

      Elements           Molality       Moles

      C                2.784e-003  2.784e-003
      Ca               1.014e-002  1.014e-002
      Cl               1.017e-001  1.017e-001
      F                7.902e-006  7.902e-006
      K                8.764e-004  8.764e-004
      Mg               2.200e-003  2.200e-003
      N                7.146e-004  7.146e-004
      Na               7.358e-002  7.358e-002
      S                4.380e-004  4.380e-004
      Si               9.051e-004  9.051e-004

----------------------------Description of solution----------------------
-----
```

```
                                    pH  =   7.524      Charge balance
                                    pe  =  11.517      Adjusted to
redox equilibrium
                       Activity of water  =   0.997
                          Ionic strength  =  1.144e-001
                      Mass of water (kg)  =  1.000e+000
                 Total alkalinity (eq/kg)  =  2.713e-003
                      Total CO2 (mol/kg)  =  2.784e-003
                    Temperature (deg C)  =  30.000
                  Electrical balance (eq)  = -6.878e-003
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -3.37
                              Iterations  =  13
                                 Total H  = 1.110187e+002
                                 Total O  = 5.552197e+001

----------------------------Distribution of species----------------------
-----

                                                     Log       Log
Log
   Species                 Molality    Activity  Molality  Activity
Gamma

   OH-                   6.427e-007  4.819e-007    -6.192    -6.317    -
0.125
   H+                    3.655e-008  2.993e-008    -7.437    -7.524    -
0.087
   H2O                   5.551e+001  9.967e-001     1.744    -0.001
0.000
C(-4)           0.000e+000
   CH4                   0.000e+000  0.000e+000  -132.534  -132.522
0.011
C(4)            2.784e-003
   HCO3-                 2.421e-003  1.886e-003    -2.616    -2.725    -
0.109
   CaHCO3+               1.225e-004  9.541e-005    -3.912    -4.020    -
0.109
   CO2                   1.174e-004  1.206e-004    -3.930    -3.919
0.011
   NaHCO3                5.869e-005  6.025e-005    -4.231    -4.220
0.011
   MgHCO3+               2.459e-005  1.899e-005    -4.609    -4.721    -
0.112
   CaCO3                 2.193e-005  2.252e-005    -4.659    -4.647
0.011
   CO3-2                 8.824e-006  3.247e-006    -5.054    -5.489    -
0.434
   NaCO3-                5.701e-006  4.402e-006    -5.244    -5.356    -
0.112
   MgCO3                 2.736e-006  2.809e-006    -5.563    -5.551
0.011
Ca              1.014e-002
   Ca+2                  9.914e-003  3.703e-003    -2.004    -2.431    -
0.428
   CaHCO3+               1.225e-004  9.541e-005    -3.912    -4.020    -
0.109
```

```
   CaSO4                  7.887e-005  8.098e-005    -4.103    -4.092
0.011
   CaCO3                  2.193e-005  2.252e-005    -4.659    -4.647
0.011
   CaF+                   2.482e-007  1.917e-007    -6.605    -6.717    -
0.112
   CaOH+                  2.650e-008  2.046e-008    -7.577    -7.689    -
0.112
   CaHSO4+                1.963e-011  1.516e-011   -10.707   -10.819    -
0.112
Cl               1.017e-001
   Cl-                    1.017e-001  7.656e-002    -0.993    -1.116    -
0.123
F                7.902e-006
   F-                     7.069e-006  5.300e-006    -5.151    -5.276    -
0.125
   MgF+                   4.161e-007  3.214e-007    -6.381    -6.493    -
0.112
   CaF+                   2.482e-007  1.917e-007    -6.605    -6.717    -
0.112
   NaF                    1.688e-007  1.733e-007    -6.773    -6.761
0.011
   HF                     2.538e-010  2.606e-010    -9.596    -9.584
0.011
   HF2-                   7.110e-015  5.491e-015   -14.148   -14.260    -
0.112
   SiF6-2                 4.497e-035  1.600e-035   -34.347   -34.796    -
0.449
H(0)             0.000e+000
   H2                     0.000e+000  0.000e+000   -41.264   -41.252
0.011
K                8.764e-004
   K+                     8.757e-004  6.592e-004    -3.058    -3.181    -
0.123
   KSO4-                  6.841e-007  5.283e-007    -6.165    -6.277    -
0.112
   KOH                    7.413e-011  7.611e-011   -10.130   -10.119
0.011
Mg               2.200e-003
   Mg+2                   2.150e-003  8.396e-004    -2.668    -3.076    -
0.408
   MgHCO3+                2.459e-005  1.899e-005    -4.609    -4.721    -
0.112
   MgSO4                  2.278e-005  2.339e-005    -4.642    -4.631
0.011
   MgCO3                  2.736e-006  2.809e-006    -5.563    -5.551
0.011
   MgF+                   4.161e-007  3.214e-007    -6.381    -6.493    -
0.112
   MgOH+                  2.049e-007  1.583e-007    -6.688    -6.801    -
0.112
N(-3)            0.000e+000
   NH4+                   0.000e+000  0.000e+000   -53.692   -53.828    -
0.136
   NH3                    0.000e+000  0.000e+000   -55.409   -55.397
0.011
```

```
   NH4SO4-                0.000e+000  0.000e+000   -56.586   -56.698    -
0.112
N(0)            3.981e-009
   N2                     1.991e-009  2.044e-009    -8.701    -8.690
0.011
N(3)            6.540e-014
   NO2-                   6.540e-014  4.845e-014   -13.184   -13.315    -
0.130
N(5)            7.146e-004
   NO3-                   7.146e-004  5.294e-004    -3.146    -3.276    -
0.130
Na              7.358e-002
   Na+                    7.348e-002  5.682e-002    -1.134    -1.246    -
0.112
   NaHCO3                 5.869e-005  6.025e-005    -4.231    -4.220
0.011
   NaSO4-                 3.982e-005  3.076e-005    -4.400    -4.512    -
0.112
   NaCO3-                 5.701e-006  4.402e-006    -5.244    -5.356    -
0.112
   NaF                    1.688e-007  1.733e-007    -6.773    -6.761
0.011
   NaOH                   1.218e-008  1.250e-008    -7.915    -7.903
0.011
O(0)            9.955e-009
   O2                     4.978e-009  5.111e-009    -8.303    -8.292
0.011
S(-2)           0.000e+000
   HS-                    0.000e+000  0.000e+000  -130.774  -130.899    -
0.125
   H2S                    0.000e+000  0.000e+000  -131.555  -131.543
0.011
   S-2                    0.000e+000  0.000e+000  -135.700  -136.147    -
0.447
S(6)            4.380e-004
   SO4-2                  2.958e-004  1.047e-004    -3.529    -3.980    -
0.451
   CaSO4                  7.887e-005  8.098e-005    -4.103    -4.092
0.011
   NaSO4-                 3.982e-005  3.076e-005    -4.400    -4.512    -
0.112
   MgSO4                  2.278e-005  2.339e-005    -4.642    -4.631
0.011
   KSO4-                  6.841e-007  5.283e-007    -6.165    -6.277    -
0.112
   HSO4-                  4.409e-010  3.405e-010    -9.356    -9.468    -
0.112
   CaHSO4+                1.963e-011  1.516e-011   -10.707   -10.819    -
0.112
   NH4SO4-                0.000e+000  0.000e+000   -56.586   -56.698    -
0.112
Si              9.051e-004
   H4SiO4                 8.981e-004  9.221e-004    -3.047    -3.035
0.011
   H3SiO4-                6.961e-006  5.376e-006    -5.157    -5.270    -
0.112
```

```
   H2SiO4-2              4.711e-011  1.676e-011   -10.327   -10.776    -
0.449
   SiF6-2                4.497e-035  1.600e-035   -34.347   -34.796    -
0.449

------------------------------Saturation indices-------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -2.03   -6.41   -4.39  CaSO4
      Aragonite         0.45   -7.92   -8.37  CaCO3
      Calcite           0.59   -7.92   -8.51  CaCO3
      CH4(g)         -129.62 -132.52   -2.90  CH4
      Chalcedony        0.46   -3.03   -3.49  SiO2
      Chrysotile       -1.75   29.84   31.59  Mg3Si2O5(OH)4
      CO2(g)           -2.39   -3.92   -1.52  CO2
      Dolomite          0.72  -16.48  -17.20  CaMg(CO3)2
      Fluorite         -2.44  -12.98  -10.54  CaF2
      Gypsum           -1.83   -6.41   -4.58  CaSO4:2H2O
      H2(g)           -38.08  -41.25   -3.17  H2
      H2O(g)           -1.38   -0.00    1.38  H2O
      H2S(g)         -130.49 -131.54   -1.05  H2S
      Halite           -3.95   -2.36    1.59  NaCl
      N2(g)            -5.41   -8.69   -3.28  N2
      NH3(g)          -57.07  -55.40    1.67  NH3
      O2(g)            -5.36   -8.29   -2.93  O2
      Quartz            0.88   -3.03   -3.91  SiO2
      Sepiolite        -0.79   14.84   15.63  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -3.82   14.84   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.36   -3.03   -2.67  SiO2
      Sulfur          -98.23  -93.46    4.77  S
      Talc              2.94   23.78   20.84  Mg3Si4O10(OH)2

------------------
End of simulation.
------------------

------------------------------------
Reading input data for simulation 5.
------------------------------------

-----------
End of run.
-----------
```

Table 2. PHREEQC output file for simulation of mixing between Domengine formation water and proposed LEC-1 injection water.

```
   Input file: C:\Documents and Settings\bschroth\My
Documents\Documents\NCPA_Lodi\NCPA_ProposedWell#2_Donengine.pqi
  Output file: C:\Documents and Settings\bschroth\My
Documents\Documents\NCPA_Lodi\NCPA_ProposedWell#2_Donengine.pqo
Database file: C:\Program Files\USGS\Phreeqc Interactive
2.14.3\phreeqc.dat

------------------
Reading data base.
------------------

      SOLUTION_MASTER_SPECIES
      SOLUTION_SPECIES
      PHASES
      EXCHANGE_MASTER_SPECIES
      EXCHANGE_SPECIES
      SURFACE_MASTER_SPECIES
      SURFACE_SPECIES
      RATES
      END
------------------------------------
Reading input data for simulation 1.
------------------------------------

      DATABASE C:\Program Files\USGS\Phreeqc Interactive
2.14.3\phreeqc.dat
      TITLE  NCPA Injection Well in Lodi: simulation of mixing with
Domengine Aquifer
      SOLUTION 1 Domengine Formation Water May 1993
      Temp  32
      pH    7.85
      pe    10
      redox pe
      units mg/l
      density     1
      Na    3200
      K     46
      Ca    761
      Mg    86
      Cl    7000
      Alkalinity  50.81 as Ca0.5(CO3)0.5
      S(6)  8     as SO4
      N(5)  14    as NO3
      Si    16.5  as SiO2
          water    1 # kg
      END
-----
TITLE
-----

  NCPA Injection Well in Lodi: simulation of mixing with Domengine Aquifer

-------------------------------------------
Beginning of initial solution calculations.
```

```
-------------------------------------------

Initial solution 1.     Domengine Formation Water May 1993

-----------------------------Solution composition------------------------
-----

      Elements           Molality       Moles

      Alkalinity       1.027e-003  1.027e-003
      Ca               1.920e-002  1.920e-002
      Cl               1.997e-001  1.997e-001
      K                1.190e-003  1.190e-003
      Mg               3.577e-003  3.577e-003
      N(5)             2.283e-004  2.283e-004
      Na               1.408e-001  1.408e-001
      S(6)             8.422e-005  8.422e-005
      Si               2.777e-004  2.777e-004

----------------------------Description of solution----------------------
-----

                                        pH  =   7.850
                                        pe  =  10.000
                        Activity of water  =   0.994
                           Ionic strength  =  2.168e-001
                       Mass of water (kg)  =  1.000e+000
                    Total carbon (mol/kg)  =  9.921e-004
                       Total CO2 (mol/kg)  =  9.921e-004
                      Temperature (deg C)  =  32.000
                  Electrical balance (eq)  = -1.359e-002
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -3.50
                                Iterations  =   6
                                   Total H  = 1.110145e+002
                                   Total O  = 5.551131e+001

----------------------------Distribution of species----------------------
-----

                                                      Log       Log
Log
   Species                  Molality    Activity  Molality  Activity
Gamma

   OH-                    1.682e-006  1.174e-006    -5.774    -5.930    -
0.156
   H+                     1.782e-008  1.413e-008    -7.749    -7.850    -
0.101
   H2O                    5.551e+001  9.938e-001     1.744    -0.003
0.000
C(4)            9.921e-004
   HCO3-                  8.178e-004  6.044e-004    -3.087    -3.219    -
0.131
   CaHCO3+                6.785e-005  5.015e-005    -4.168    -4.300    -
0.131
   NaHCO3                 3.353e-005  3.525e-005    -4.475    -4.453
0.022
```

```
   CaCO3                  2.529e-005  2.659e-005    -4.597    -4.575
0.022
   CO2                    1.709e-005  1.796e-005    -4.767    -4.746
0.022
   MgHCO3+                1.173e-005  8.687e-006    -4.931    -5.061    -
0.130
   NaCO3-                 8.399e-006  6.223e-006    -5.076    -5.206    -
0.130
   CO3-2                  7.649e-006  2.282e-006    -5.116    -5.642    -
0.525
   MgCO3                  2.733e-006  2.873e-006    -5.563    -5.542
0.022
Ca              1.920e-002
   Ca+2                   1.909e-002  5.931e-003    -1.719    -2.227    -
0.508
   CaHCO3+                6.785e-005  5.015e-005    -4.168    -4.300    -
0.131
   CaCO3                  2.529e-005  2.659e-005    -4.597    -4.575
0.022
   CaSO4                  1.736e-005  1.825e-005    -4.761    -4.739
0.022
   CaOH+                  9.347e-008  6.925e-008    -7.029    -7.160    -
0.130
   CaHSO4+                2.237e-012  1.657e-012   -11.650   -11.781    -
0.130
Cl              1.997e-001
   Cl-                    1.997e-001  1.404e-001    -0.700    -0.853    -
0.153
H(0)            2.511e-039
   H2                     1.255e-039  1.320e-039   -38.901   -38.880
0.022
K               1.190e-003
   K+                     1.190e-003  8.364e-004    -2.925    -3.078    -
0.153
   KSO4-                  1.293e-007  9.578e-008    -6.888    -7.019    -
0.130
   KOH                    1.941e-010  2.040e-010    -9.712    -9.690
0.022
Mg              3.577e-003
   Mg+2                   3.558e-003  1.185e-003    -2.449    -2.926    -
0.478
   MgHCO3+                1.173e-005  8.687e-006    -4.931    -5.061    -
0.130
   MgSO4                  4.558e-006  4.791e-006    -5.341    -5.320
0.022
   MgCO3                  2.733e-006  2.873e-006    -5.563    -5.542
0.022
   MgOH+                  7.576e-007  5.612e-007    -6.121    -6.251    -
0.130
N(5)            2.283e-004
   NO3-                   2.283e-004  1.564e-004    -3.641    -3.806    -
0.164
Na              1.408e-001
   Na+                    1.407e-001  1.037e-001    -0.852    -0.984    -
0.133
   NaHCO3                 3.353e-005  3.525e-005    -4.475    -4.453
0.022
```

```
   NaSO4-                1.060e-005  7.851e-006    -4.975    -5.105    -
0.130
   NaCO3-                8.399e-006  6.223e-006    -5.076    -5.206    -
0.130
   NaOH                  4.586e-008  4.821e-008    -7.339    -7.317
0.022
O(0)            7.250e-013
   O2                    3.625e-013  3.811e-013   -12.441   -12.419
0.022
S(6)            8.422e-005
   SO4-2                 5.158e-005  1.446e-005    -4.288    -4.840    -
0.552
   CaSO4                 1.736e-005  1.825e-005    -4.761    -4.739
0.022
   NaSO4-                1.060e-005  7.851e-006    -4.975    -5.105    -
0.130
   MgSO4                 4.558e-006  4.791e-006    -5.341    -5.320
0.022
   KSO4-                 1.293e-007  9.578e-008    -6.888    -7.019    -
0.130
   HSO4-                 3.137e-011  2.324e-011   -10.503   -10.634    -
0.130
   CaHSO4+               2.237e-012  1.657e-012   -11.650   -11.781    -
0.130
Si              2.777e-004
   H4SiO4                2.726e-004  2.866e-004    -3.564    -3.543
0.022
   H3SiO4-               5.096e-006  3.775e-006    -5.293    -5.423    -
0.130
   H2SiO4-2              9.346e-011  2.815e-011   -10.029   -10.550    -
0.521

------------------------------Saturation indices--------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -2.67   -7.07   -4.40  CaSO4
      Aragonite         0.52   -7.87   -8.38  CaCO3
      Calcite           0.65   -7.87   -8.52  CaCO3
      Chalcedony       -0.07   -3.54   -3.47  SiO2
      Chrysotile       -0.12   31.23   31.35  Mg3Si2O5(OH)4
      CO2(g)           -3.20   -4.75   -1.55  CO2
      Dolomite          0.81  -16.44  -17.25  CaMg(CO3)2
      Gypsum           -2.49   -7.07   -4.59  CaSO4:2H2O
      H2(g)           -35.70  -38.88   -3.18  H2
      H2O(g)           -1.34   -0.00    1.33  H2O
      Halite           -3.43   -1.84    1.60  NaCl
      O2(g)            -9.48  -12.42   -2.94  O2
      Quartz            0.34   -3.54   -3.88  SiO2
      Sepiolite        -0.66   14.92   15.58  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -3.74   14.92   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.88   -3.54   -2.66  SiO2
      Talc              3.54   24.16   20.62  Mg3Si4O10(OH)2

------------------
End of simulation.
```

```
------------------

------------------------------------
Reading input data for simulation 2.
------------------------------------

      SOLUTION 2 Calculated chemistry for blowdown water to be injected in
Well 2
      Temp  25
      pH    7.5
      pe    10
      redox pe
      units mg/l
      density     1
      Na    456.9526511
      K     95.15408947
      Ca    159.434134
      Mg    58.95128618
      Cl    527.4024822
      Alkalinity  107.3076273 as Ca0.5(CO3)0.5
      S(6)  488.1867318 as SO4
      N(5)  253.7442386 as NO3
      F     0
      Si    36.93559585 as SiO2
      END
-------------------------------------------
Beginning of initial solution calculations.
-------------------------------------------

Initial solution 2.     Calculated chemistry for blowdown water to be
injected in Well 2

-----------------------------Solution composition-------------------------
-----

      Elements           Molality       Moles

      Alkalinity       2.149e-003  2.149e-003
      Ca               3.987e-003  3.987e-003
      Cl               1.491e-002  1.491e-002
      K                2.439e-003  2.439e-003
      Mg               2.430e-003  2.430e-003
      N(5)             4.101e-003  4.101e-003
      Na               1.992e-002  1.992e-002
      S(6)             5.093e-003  5.093e-003
      Si               6.161e-004  6.161e-004

----------------------------Description of solution-----------------------
-----

                                        pH  =   7.500
                                        pe  =  10.000
                         Activity of water  =   0.999
                            Ionic strength  =  3.994e-002
                       Mass of water (kg)  =  1.000e+000
                    Total carbon (mol/kg)  =  2.250e-003
                       Total CO2 (mol/kg)  =  2.250e-003
```

```
                    Temperature (deg C)  =  25.000
                 Electrical balance (eq)  =  3.847e-003
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =   6.24
                              Iterations  =   7
                                 Total H  = 1.110170e+002
                                 Total O  = 5.554799e+001

----------------------------Distribution of species-----------------------
-----

                                                     Log       Log
Log
   Species                 Molality    Activity  Molality  Activity
Gamma

   OH-                   3.827e-007  3.163e-007    -6.417    -6.500    -
0.083
   H+                    3.664e-008  3.162e-008    -7.436    -7.500    -
0.064
   H2O                   5.551e+001  9.991e-001     1.744    -0.000
0.000
C(4)             2.250e-003
   HCO3-                 2.031e-003  1.708e-003    -2.692    -2.767    -
0.075
   CO2                   1.205e-004  1.216e-004    -3.919    -3.915
0.004
   CaHCO3+               4.311e-005  3.626e-005    -4.365    -4.441    -
0.075
   MgHCO3+               2.408e-005  2.009e-005    -4.618    -4.697    -
0.079
   NaHCO3                1.570e-005  1.584e-005    -4.804    -4.800
0.004
   CaCO3                 7.015e-006  7.080e-006    -5.154    -5.150
0.004
   CO3-2                 5.063e-006  2.534e-006    -5.296    -5.596    -
0.301
   MgCO3                 2.408e-006  2.430e-006    -5.618    -5.614
0.004
   NaCO3-                9.326e-007  7.780e-007    -6.030    -6.109    -
0.079
Ca               3.987e-003
   Ca+2                  3.319e-003  1.663e-003    -2.479    -2.779    -
0.300
   CaSO4                 6.177e-004  6.234e-004    -3.209    -3.205
0.004
   CaHCO3+               4.311e-005  3.626e-005    -4.365    -4.441    -
0.075
   CaCO3                 7.015e-006  7.080e-006    -5.154    -5.150
0.004
   CaOH+                 1.045e-008  8.721e-009    -7.981    -8.059    -
0.079
   CaHSO4+               1.385e-010  1.155e-010    -9.859    -9.937    -
0.079
Cl               1.491e-002
   Cl-                   1.491e-002  1.234e-002    -1.827    -1.909    -
0.082
H(0)             1.403e-038
```

```
   H2                    7.015e-039  7.079e-039   -38.154   -38.150
0.004
K               2.439e-003
   K+                    2.407e-003  1.992e-003    -2.618    -2.701    -
0.082
   KSO4-                 3.152e-005  2.630e-005    -4.501    -4.580    -
0.079
   KOH                   2.162e-010  2.182e-010    -9.665    -9.661
0.004
Mg              2.430e-003
   Mg+2                  1.965e-003  1.005e-003    -2.707    -2.998    -
0.291
   MgSO4                 4.385e-004  4.425e-004    -3.358    -3.354
0.004
   MgHCO3+               2.408e-005  2.009e-005    -4.618    -4.697    -
0.079
   MgCO3                 2.408e-006  2.430e-006    -5.618    -5.614
0.004
   MgOH+                 1.382e-007  1.153e-007    -6.860    -6.938    -
0.079
N(5)            4.101e-003
   NO3-                  4.101e-003  3.372e-003    -2.387    -2.472    -
0.085
Na              1.992e-002
   Na+                   1.972e-002  1.649e-002    -1.705    -1.783    -
0.078
   NaSO4-                1.861e-004  1.552e-004    -3.730    -3.809    -
0.079
   NaHCO3                1.570e-005  1.584e-005    -4.804    -4.800
0.004
   NaCO3-                9.326e-007  7.780e-007    -6.030    -6.109    -
0.079
   NaOH                  3.410e-009  3.442e-009    -8.467    -8.463
0.004
O(0)            1.645e-016
   O2                    8.226e-017  8.302e-017   -16.085   -16.081
0.004
S(6)            5.093e-003
   SO4-2                 3.819e-003  1.878e-003    -2.418    -2.726    -
0.308
   CaSO4                 6.177e-004  6.234e-004    -3.209    -3.205
0.004
   MgSO4                 4.385e-004  4.425e-004    -3.358    -3.354
0.004
   NaSO4-                1.861e-004  1.552e-004    -3.730    -3.809    -
0.079
   KSO4-                 3.152e-005  2.630e-005    -4.501    -4.580    -
0.079
   HSO4-                 6.923e-009  5.775e-009    -8.160    -8.238    -
0.079
   CaHSO4+               1.385e-010  1.155e-010    -9.859    -9.937    -
0.079
Si              6.161e-004
   H4SiO4                6.126e-004  6.183e-004    -3.213    -3.209
0.004
   H3SiO4-               3.456e-006  2.883e-006    -5.461    -5.540    -
0.079
```

```
   H2SiO4-2              1.281e-011  6.201e-012   -10.893   -11.208    -
0.315

------------------------------Saturation indices-------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -1.14   -5.51   -4.36  CaSO4
      Aragonite        -0.04   -8.38   -8.34  CaCO3
      Calcite           0.10   -8.38   -8.48  CaCO3
      Chalcedony        0.34   -3.21   -3.55  SiO2
      Chrysotile       -2.61   29.59   32.20  Mg3Si2O5(OH)4
      CO2(g)           -2.45   -3.92   -1.47  CO2
      Dolomite          0.12  -16.97  -17.09  CaMg(CO3)2
      Gypsum           -0.93   -5.51   -4.58  CaSO4:2H2O
      H2(g)           -35.00  -38.15   -3.15  H2
      H2O(g)           -1.51   -0.00    1.51  H2O
      Halite           -5.27   -3.69    1.58  NaCl
      O2(g)           -13.19  -16.08   -2.89  O2
      Quartz            0.77   -3.21   -3.98  SiO2
      Sepiolite        -1.38   14.38   15.76  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -4.28   14.38   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.50   -3.21   -2.71  SiO2
      Talc              1.77   23.17   21.40  Mg3Si4O10(OH)2

------------------
End of simulation.
------------------

-----------------------------------
Reading input data for simulation 3.
-----------------------------------

      MIX 1
          1    0.75
          2    0.25
      END
----------------------------------------
Beginning of batch-reaction calculations.
----------------------------------------

Reaction step 1.

Using mix 1.

Mixture 1.

       7.500e-001 Solution 1  Domengine Formation Water May 1993
       2.500e-001 Solution 2  Calculated chemistry for blowdown water to
be injected in Well 2

-----------------------------Solution composition------------------------
-----

      Elements           Molality       Moles
```

```
      C                 1.307e-003  1.307e-003
      Ca                1.540e-002  1.540e-002
      Cl                1.535e-001  1.535e-001
      K                 1.502e-003  1.502e-003
      Mg                3.291e-003  3.291e-003
      N                 1.197e-003  1.197e-003
      Na                1.106e-001  1.106e-001
      S                 1.336e-003  1.336e-003
      Si                3.623e-004  3.623e-004

----------------------------Description of solution-----------------------
-----

                                       pH  =   7.668      Charge balance
                                       pe  =  11.362      Adjusted to
redox equilibrium
                        Activity of water  =   0.995
                           Ionic strength  =  1.721e-001
                       Mass of water (kg)  =  1.000e+000
                  Total alkalinity (eq/kg)  =  1.307e-003
                       Total CO2 (mol/kg)  =  1.307e-003
                     Temperature (deg C)  =  30.250
                   Electrical balance (eq)  = -9.228e-003
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -3.01
                                Iterations  =  13
                                   Total H  = 1.110151e+002
                                   Total O  = 5.552048e+001

----------------------------Distribution of species-----------------------
-----

                                                      Log       Log
Log
   Species                  Molality    Activity  Molality  Activity
Gamma

   OH-                    9.514e-007  6.825e-007    -6.022    -6.166    -
0.144
   H+                     2.678e-008  2.148e-008    -7.572    -7.668    -
0.096
   H2O                    5.551e+001  9.951e-001     1.744    -0.002
0.000
C(-4)           0.000e+000
   CH4                    0.000e+000  0.000e+000  -132.988  -132.971
0.017
C(4)            1.307e-003
   HCO3-                  1.109e-003  8.361e-004    -2.955    -3.078    -
0.123
   CaHCO3+                7.598e-005  5.727e-005    -4.119    -4.242    -
0.123
   NaHCO3                 3.740e-005  3.891e-005    -4.427    -4.410
0.017
   CO2                    3.684e-005  3.833e-005    -4.434    -4.416
0.017
   CaCO3                  1.823e-005  1.897e-005    -4.739    -4.722
0.017
```

```
   MgHCO3+                1.507e-005  1.132e-005    -4.822    -4.946    -
0.124
   CO3-2                  6.240e-006  2.015e-006    -5.205    -5.696    -
0.491
   NaCO3-                 5.361e-006  4.028e-006    -5.271    -5.395    -
0.124
   MgCO3                  2.258e-006  2.350e-006    -5.646    -5.629
0.017
Ca               1.540e-002
   Ca+2                   1.504e-002  4.998e-003    -1.823    -2.301    -
0.479
   CaSO4                  2.614e-004  2.720e-004    -3.583    -3.565
0.017
   CaHCO3+                7.598e-005  5.727e-005    -4.119    -4.242    -
0.123
   CaCO3                  1.823e-005  1.897e-005    -4.739    -4.722
0.017
   CaOH+                  5.114e-008  3.842e-008    -7.291    -7.415    -
0.124
   CaHSO4+                4.880e-011  3.667e-011   -10.312   -10.436    -
0.124
Cl               1.535e-001
   Cl-                    1.535e-001  1.108e-001    -0.814    -0.956    -
0.142
H(0)             0.000e+000
   H2                     0.000e+000  0.000e+000   -41.250   -41.233
0.017
K                1.502e-003
   K+                     1.499e-003  1.082e-003    -2.824    -2.966    -
0.142
   KSO4-                  2.877e-006  2.162e-006    -5.541    -5.665    -
0.124
   KOH                    1.670e-010  1.737e-010    -9.777    -9.760
0.017
Mg               3.291e-003
   Mg+2                   3.197e-003  1.127e-003    -2.495    -2.948    -
0.453
   MgSO4                  7.541e-005  7.846e-005    -4.123    -4.105
0.017
   MgHCO3+                1.507e-005  1.132e-005    -4.822    -4.946    -
0.124
   MgCO3                  2.258e-006  2.350e-006    -5.646    -5.629
0.017
   MgOH+                  4.022e-007  3.021e-007    -6.396    -6.520    -
0.124
N(-3)            0.000e+000
   NH4+                   0.000e+000  0.000e+000   -53.782   -53.941    -
0.159
   NH3                    0.000e+000  0.000e+000   -55.376   -55.359
0.017
   NH4SO4-                0.000e+000  0.000e+000   -56.292   -56.416    -
0.124
N(0)             4.289e-009
   N2                     2.144e-009  2.231e-009    -8.669    -8.651
0.017
N(3)             1.083e-013
```

```
   NO2-                  1.083e-013  7.642e-014   -12.966   -13.117    -
0.151
N(5)            1.197e-003
   NO3-                  1.197e-003  8.446e-004    -2.922    -3.073    -
0.151
Na              1.106e-001
   Na+                   1.104e-001  8.276e-002    -0.957    -1.082    -
0.125
   NaSO4-                1.483e-004  1.114e-004    -3.829    -3.953    -
0.124
   NaHCO3                3.740e-005  3.891e-005    -4.427    -4.410
0.017
   NaCO3-                5.361e-006  4.028e-006    -5.271    -5.395    -
0.124
   NaOH                  2.434e-008  2.533e-008    -7.614    -7.596
0.017
O(0)            1.072e-008
   O2                    5.361e-009  5.578e-009    -8.271    -8.254
0.017
S(-2)           0.000e+000
   HS-                   0.000e+000  0.000e+000  -130.455  -130.600    -
0.144
   H2S                   0.000e+000  0.000e+000  -131.408  -131.391
0.017
   S-2                   0.000e+000  0.000e+000  -135.189  -135.696    -
0.507
S(6)            1.336e-003
   SO4-2                 8.484e-004  2.599e-004    -3.071    -3.585    -
0.514
   CaSO4                 2.614e-004  2.720e-004    -3.583    -3.565
0.017
   NaSO4-                1.483e-004  1.114e-004    -3.829    -3.953    -
0.124
   MgSO4                 7.541e-005  7.846e-005    -4.123    -4.105
0.017
   KSO4-                 2.877e-006  2.162e-006    -5.541    -5.665    -
0.124
   HSO4-                 8.122e-010  6.102e-010    -9.090    -9.215    -
0.124
   CaHSO4+               4.880e-011  3.667e-011   -10.312   -10.436    -
0.124
   NH4SO4-               0.000e+000  0.000e+000   -56.292   -56.416    -
0.124
Si              3.623e-004
   H4SiO4                3.582e-004  3.727e-004    -3.446    -3.429
0.017
   H3SiO4-               4.063e-006  3.052e-006    -5.391    -5.515    -
0.124
   H2SiO4-2              4.225e-011  1.346e-011   -10.374   -10.871    -
0.497

------------------------------Saturation indices--------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -1.50   -5.89   -4.39  CaSO4
```

```
      Aragonite         0.37   -8.00   -8.37  CaCO3
      Calcite           0.51   -8.00   -8.51  CaCO3
      CH4(g)         -130.07 -132.97   -2.90  CH4
      Chalcedony        0.07   -3.42   -3.49  SiO2
      Chrysotile       -1.26   30.30   31.56  Mg3Si2O5(OH)4
      CO2(g)           -2.89   -4.42   -1.53  CO2
      Dolomite          0.57  -16.64  -17.21  CaMg(CO3)2
      Gypsum           -1.31   -5.89   -4.58  CaSO4:2H2O
      H2(g)           -38.06  -41.23   -3.17  H2
      H2O(g)           -1.38   -0.00    1.38  H2O
      H2S(g)         -130.34 -131.39   -1.05  H2S
      Halite           -3.63   -2.04    1.59  NaCl
      N2(g)            -5.37   -8.65   -3.28  N2
      NH3(g)          -57.03  -55.36    1.67  NH3
      O2(g)            -5.33   -8.25   -2.93  O2
      Quartz            0.48   -3.42   -3.90  SiO2
      Sepiolite        -1.13   14.49   15.62  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -4.17   14.49   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.75   -3.42   -2.67  SiO2
      Sulfur          -98.09  -93.33    4.76  S
      Talc              2.65   23.46   20.81  Mg3Si4O10(OH)2

------------------
End of simulation.
------------------

-------------------------------------
Reading input data for simulation 4.
-------------------------------------

      MIX 2
          1    0.5
          2    0.5
      END
----------------------------------------
Beginning of batch-reaction calculations.
----------------------------------------

Reaction step 1.

Using mix 2.

Mixture 2.

       5.000e-001 Solution 1  Domengine Formation Water May 1993
       5.000e-001 Solution 2  Calculated chemistry for blowdown water to
be injected in Well 2

-----------------------------Solution composition-------------------------
-----

      Elements           Molality       Moles

      C                1.621e-003  1.621e-003
      Ca               1.159e-002  1.159e-002
      Cl               1.073e-001  1.073e-001
      K                1.814e-003  1.814e-003
```

```
      Mg                3.004e-003  3.004e-003
      N                 2.165e-003  2.165e-003
      Na                8.034e-002  8.034e-002
      S                 2.589e-003  2.589e-003
      Si                4.469e-004  4.469e-004

----------------------------Description of solution-----------------------
-----

                                        pH  =   7.561      Charge balance
                                        pe  =  11.657      Adjusted to
redox equilibrium
                        Activity of water  =   0.996
                           Ionic strength  =  1.277e-001
                       Mass of water (kg)  =  1.000e+000
                  Total alkalinity (eq/kg)  =  1.588e-003
                       Total CO2 (mol/kg)  =  1.621e-003
                      Temperature (deg C)  =  28.500
                   Electrical balance (eq)  = -4.870e-003
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -2.17
                                Iterations  =  12
                                   Total H  = 1.110157e+002
                                   Total O  = 5.552965e+001

----------------------------Distribution of species-----------------------
-----

                                                     Log       Log
Log
   Species                  Molality    Activity  Molality  Activity
Gamma

   OH-                    6.343e-007  4.705e-007    -6.198    -6.327    -
0.130
   H+                     3.375e-008  2.750e-008    -7.472    -7.561    -
0.089
   H2O                    5.551e+001  9.964e-001     1.744    -0.002
0.000
C(-4)           0.000e+000
   CH4                    0.000e+000  0.000e+000  -134.023  -134.010
0.013
C(4)            1.621e-003
   HCO3-                  1.403e-003  1.084e-003    -2.853    -2.965    -
0.112
   CaHCO3+                7.533e-005  5.821e-005    -4.123    -4.235    -
0.112
   CO2                    6.278e-005  6.466e-005    -4.202    -4.189
0.013
   NaHCO3                 3.638e-005  3.746e-005    -4.439    -4.426
0.013
   MgHCO3+                1.811e-005  1.389e-005    -4.742    -4.857    -
0.115
   CaCO3                  1.392e-005  1.434e-005    -4.856    -4.844
0.013
   CO3-2                  5.551e-006  1.978e-006    -5.256    -5.704    -
0.448
```

```
   NaCO3-                 3.514e-006  2.695e-006    -5.454    -5.569    -
0.115
   MgCO3                  2.082e-006  2.144e-006    -5.682    -5.669
0.013
Ca              1.159e-002
   Ca+2                   1.104e-002  4.004e-003    -1.957    -2.397    -
0.440
   CaSO4                  4.693e-004  4.833e-004    -3.329    -3.316
0.013
   CaHCO3+                7.533e-005  5.821e-005    -4.123    -4.235    -
0.112
   CaCO3                  1.392e-005  1.434e-005    -4.856    -4.844
0.013
   CaOH+                  3.140e-008  2.408e-008    -7.503    -7.618    -
0.115
   CaHSO4+                1.062e-010  8.144e-011    -9.974   -10.089    -
0.115
Cl              1.073e-001
   Cl-                    1.073e-001  7.994e-002    -0.969    -1.097    -
0.128
H(0)            0.000e+000
   H2                     0.000e+000  0.000e+000   -41.613   -41.600
0.013
K               1.814e-003
   K+                     1.807e-003  1.346e-003    -2.743    -2.871    -
0.128
   KSO4-                  7.672e-006  5.884e-006    -5.115    -5.230    -
0.115
   KOH                    1.642e-010  1.691e-010    -9.785    -9.772
0.013
Mg              3.004e-003
   Mg+2                   2.826e-003  1.076e-003    -2.549    -2.968    -
0.419
   MgSO4                  1.569e-004  1.615e-004    -3.805    -3.792
0.013
   MgHCO3+                1.811e-005  1.389e-005    -4.742    -4.857    -
0.115
   MgCO3                  2.082e-006  2.144e-006    -5.682    -5.669
0.013
   MgOH+                  2.524e-007  1.935e-007    -6.598    -6.713    -
0.115
N(-3)           0.000e+000
   NH4+                   0.000e+000  0.000e+000   -54.030   -54.172    -
0.142
   NH3                    0.000e+000  0.000e+000   -55.762   -55.749
0.013
   NH4SO4-                0.000e+000  0.000e+000   -56.179   -56.294    -
0.115
N(0)            6.683e-009
   N2                     3.341e-009  3.441e-009    -8.476    -8.463
0.013
N(3)            1.257e-013
   NO2-                   1.257e-013  9.206e-014   -12.901   -13.036    -
0.135
N(5)            2.165e-003
   NO3-                   2.165e-003  1.585e-003    -2.665    -2.800    -
0.135
```

```
Na              8.034e-002
   Na+                  8.006e-002  6.144e-002    -1.097    -1.212    -
0.115
   NaSO4-               2.404e-004  1.843e-004    -3.619    -3.734    -
0.115
   NaHCO3               3.638e-005  3.746e-005    -4.439    -4.426
0.013
   NaCO3-               3.514e-006  2.695e-006    -5.454    -5.569    -
0.115
   NaOH                 1.428e-008  1.471e-008    -7.845    -7.832
0.013
O(0)            1.668e-008
   O2                   8.339e-009  8.588e-009    -8.079    -8.066
0.013
S(-2)           0.000e+000
   HS-                  0.000e+000  0.000e+000  -131.260  -131.390    -
0.130
   H2S                  0.000e+000  0.000e+000  -132.066  -132.053
0.013
   S-2                  0.000e+000  0.000e+000  -136.183  -136.644    -
0.461
S(6)            2.589e-003
   SO4-2                1.714e-003  5.857e-004    -2.766    -3.232    -
0.466
   CaSO4                4.693e-004  4.833e-004    -3.329    -3.316
0.013
   NaSO4-               2.404e-004  1.843e-004    -3.619    -3.734    -
0.115
   MgSO4                1.569e-004  1.615e-004    -3.805    -3.792
0.013
   KSO4-                7.672e-006  5.884e-006    -5.115    -5.230    -
0.115
   HSO4-                2.206e-009  1.692e-009    -8.656    -8.772    -
0.115
   CaHSO4+              1.062e-010  8.144e-011    -9.974   -10.089    -
0.115
   NH4SO4-              0.000e+000  0.000e+000   -56.179   -56.294    -
0.115
Si              4.469e-004
   H4SiO4               4.433e-004  4.565e-004    -3.353    -3.341
0.013
   H3SiO4-              3.596e-006  2.758e-006    -5.444    -5.559    -
0.115
   H2SiO4-2             2.466e-011  8.528e-012   -10.608   -11.069    -
0.461

------------------------------Saturation indices-------------------------
-----

      Phase               SI log IAP  log KT

      Anhydrite        -1.25   -5.63   -4.38  CaSO4
      Aragonite         0.26   -8.10   -8.36  CaCO3
      Calcite           0.40   -8.10   -8.50  CaCO3
      CH4(g)         -131.12 -134.01   -2.89  CH4
      Chalcedony        0.17   -3.34   -3.51  SiO2
      Chrysotile       -1.99   29.78   31.77  Mg3Si2O5(OH)4
```

```
      CO2(g)           -2.68   -4.19   -1.51  CO2
      Dolomite          0.40  -16.77  -17.17  CaMg(CO3)2
      Gypsum           -1.05   -5.63   -4.58  CaSO4:2H2O
      H2(g)           -38.44  -41.60   -3.16  H2
      H2O(g)           -1.42   -0.00    1.42  H2O
      H2S(g)         -131.02 -132.05   -1.04  H2S
      Halite           -3.90   -2.31    1.59  NaCl
      N2(g)            -5.19   -8.46   -3.27  N2
      NH3(g)          -57.45  -55.75    1.70  NH3
      O2(g)            -5.15   -8.07   -2.92  O2
      Quartz            0.59   -3.34   -3.93  SiO2
      Sepiolite        -1.38   14.29   15.67  Mg2Si3O7.5OH:3H2O
      Sepiolite(d)     -4.37   14.29   18.66  Mg2Si3O7.5OH:3H2O
      SiO2(a)          -0.65   -3.34   -2.68  SiO2
      Sulfur          -98.42  -93.62    4.80  S
      Talc              2.10   23.10   21.00  Mg3Si4O10(OH)2

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End of simulation.
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Reading input data for simulation 5.
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End of run.
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APPENDIX 8

2007 Mechanical Integrity Testing Procedures

Procedure

Mechanical Integrity Test of
Northern California Power Agency (NCPA)
Lodi Facility Injection Well STIG #1

To Be Performed on
February 7th and February 8th, 2007

Prepared on:

January 17, 2007

Prepared by:

Fairchild and Wells, Inc.
1011 Highway 6 South, Suite 304
Houston, Texas 77077
Tel (281) 497-8990

Annulus Pressure Test (APT)

Wednesday, January 7, 2007

1. The annulus pressure is maintained at about 120 psig under normal shut-in conditions. To accomplish the casing/annulus high pressure test, the normal instrumentation for the well is modified from the configuration used in normal operations. For the test, the pressure transducer (PIT-3726) that usually transmits annulus pressure data to the central computer is disconnected and in its place the normal wellhead transducer (PIT-3725) is connected to the annulus with a temporary stainless steel tube. This modification is made in order to have a pressure transducer with an adequate operating pressure range.

2. Pressure up the tubing-casing annulus to approximately 885 psig. This pressure is greater than the 720 psig rating on the injection piping system, however, less than the maximum permitted pressure of 975 psig. Under disposal operations, the maximum operating pressure would be limited by the injection piping system.

3. Monitor the annulus pressure for a minimum of 30 minutes. Annulus pressure will be recorded by the plant's DCS computer during the test. The time and pressure data collected during the APT will be recorded in numerical form every minute and presented in a table. In addition, NCPA will supply a graphical plot of the time and pressure recorded by the plant's computer. Both the numerical tabular data and graphic recording of the APT will be provided to NCPA's consultant, Fairchild and Wells, Inc. for inclusion in the MIT report.

4. The well will pass the annulus pressure mechanical integrity test if there is less than a five (5) percent decrease in pressure over a minimum 30 minute test period.

5. Following the monitoring period, the excess pressure on the annulus will be bled off into the receiver.

Temperature and Bottomhole Pressure Survey

Wednesday, January 7, 2007

1. The well should be shut in at least 24 hours prior to conducting the temperature/pressure survey.

2. Welaco Well Analysis Corp. of Bakersfield California will provide the electric line wireline logging unit including the temperature/pressure recording tool. The wireline truck will arrive on Wednesday, January 7th and left at the NCPA Lodi Facility site over night so that work can begin at 7:00 AM the next day.

Thursday, January 8, 2007

1. Begin rigging up the lubricator and wireline logging unit at approximately 7:00 AM. Normally after 24 hours of shut-in the wellhead pressure will be on a vacuum with the fluid level at or near the surface.

2. The logging tool will consist of a collar log above the temperature tool, which is in turn above the pressure tool. The bottom of the pressure tool will be depth datum, zeroed at KB elevation. The temperature sensor in the temperature tool is located approximately 3 feet above the bottom of the pressure tool. The bottom of the pressure tool is the reference point for depth measurements.

3. The temperature survey will consist of two passes. Begin running the tool downhole at approximately 8:00 AM and conduct the first pass temperature log. The first pass will be made while running the tool in the hole at approximately 50 feet per minute.

4. Tag bottom and record the depth. Bottom tagged on the previous December, 2005 survey was at 4,558 feet. Set the tool at a depth of 4,100 feet KB.

5. Inject plant waste water at a constant rate of 100 gpm for approximately 1 hour, beginning at approximately at 9:30 AM and completing injection at approximately 10:30 AM. Injection water will be pumped from the plant's injection water storage tank by two triplex pumps through a single cartridge system and into the well. Perform an instantaneous shut in and record the bottom hole pressure and temperature for approximately 5 hours.

6. At approximately 3:30 PM begin the second temperature survey pass while pulling out of the hole at approximately 50 feet per minute to surface.

7. Logging should be completed by about 5:00 PM. A field copy of the temperature logs should be supplied to NCPA's consultant, Fairchild and Wells. In addition, the digital temperature and pressure data should be supplied to Fairchild and Wells, Inc. on a floppy diskette or CD on site.

8. Rig down the wireline unit and release the well to the plant. Job estimated to be complete by about 6:00 PM.

APPENDIX 9

MSDS for Wastewater Additives

MATERIAL SAFETY DATA SHEET

PRODUCT

NALCO 7330

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **NALCO 7330**

COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 3 / 3 FLAMMABILITY : 0 / 0 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
5-Chloro-2-Methyl-4-Isothiazolin-3-one	26172-55-4	1 - 5
2-Methyl-4-Isothiazolin-3-one	2682-20-4	0.1 - 1
Magnesium Nitrate	10377-60-3	1 - 5

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

DANGER
CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE OR SKIN BURNS. HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN. Do not get in eyes, on skin or on clothing. Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals.
Mixers, loaders, and others exposed to this product must wear: long-sleeved shirt and long pants; chemical resistant gloves such as nitrile or butyl rubber; shoes plus socks; goggles and face shield; and chemical resistant apron. Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Users should remove PPE immediately after handling the product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly. Do not apply this product in a way that will contact workers or other persons. May evolve oxides of carbon (COx) under fire conditions. May evolve HCl under fire conditions. May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions. Not flammable or combustible.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT :
May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered. Repeated or prolonged contact may cause skin sensitization.

INGESTION :
Not a likely route of exposure. Corrosive; causes chemical burns to the mouth, throat and stomach.

INHALATION :
Not a likely route of exposure. Irritating, in high concentrations, to the eyes, nose, throat and lungs.

SYMPTOMS OF EXPOSURE :
Acute :
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic :
A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS :
A review of available data does not identify any worsening of existing conditions.

4. FIRST AID MEASURES

IF IN EYES: Hold eyes open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told by a poison control center or doctor.

IF ON SKIN: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or ambulances, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for treatment advice

NOTE TO PHYSICIAN :
Probable mucosal damage may contraindicate the use of gastric lavage. Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : None

EXTINGUISHING MEDIA :
Not expected to burn. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :
May evolve oxides of carbon (COx) under fire conditions. May evolve HCl under fire conditions. May evolve oxides of nitrogen (NOx) and sulfur (SOx) under fire conditions. Not flammable or combustible.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Ensure clean-up is conducted by trained personnel only. Ventilate spill area if possible. Do not touch spilled material. Stop or reduce any leaks if it is safe to do so. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Soak up with inert absorbent material. Transfer contaminated material to suitable containers for disposal. Contaminated surfaces should be swabbed with deactivation solution, let stand for 30 minutes and rinse thoroughly with clean water. DO NOT add deactivation solution to the waste container to deactivate the absorbed material. *DEACTIVATION SOLUTION - prepare fresh a solution of 5% Sodium bicarbonate and 5% Sodium hypochlorite in water. Use a ratio of 10 volumes decontamination solution per estimated volume of residual spill. Wash site of spillage thoroughly with water. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
This pesticide is toxic to fish and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters, unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA. Do not contaminate water by cleaning of equipment or disposal of waste. Apply this pesticide only as specified on this label.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid generating aerosols and mists. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available.

STORAGE CONDITIONS :
Store the containers tightly closed. Store separately from oxidizers. Store in suitable labelled containers.

SUITABLE CONSTRUCTION MATERIAL :
Stainless Steel 316L, Polyethylene, Polypropylene, Viton

UNSUITABLE CONSTRUCTION MATERIAL :
Steel

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
This product contains the following component(s) with a recognised or recommended OEL value:
Manufacturer's Recommendation :
Substance(s)

5-Chloro-2-Methyl-4-Isothiazolin-3-one	TWA: 0.076 mg/m3 STEL: 0.23 mg/m3

Manufacturer's Recommendation :
Substance(s)

2-Methyl-4-Isothiazolin-3-one	TWA: 1.5 mg/m3 STEL: 4.5 mg/m3

ENGINEERING MEASURES :
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

RESPIRATORY PROTECTION :
If significant mists, vapors or aerosols are generated an approved respirator is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider the use of filter type: Particulate filter - HEPA. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
PVC gloves

SKIN PROTECTION :
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION :
Wear a face shield with chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Eye wash station and safety shower are necessary. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

HUMAN EXPOSURE CHARACTERIZATION :
Based on our recommended product application and personal protective equipment, the potential human exposure is: Moderate

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Light green Light yellow
ODOR	Mild

SPECIFIC GRAVITY	1.026
DENSITY	8.5 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	3.0 - 5.0
FREEZING POINT	25 °F / -4 °C
BOILING POINT	/ 100 °C
VOC CONTENT	0.80 % EPA Method 24

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Freezing temperatures.

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon, Oxides of nitrogen, Oxides of sulfur, HCl

11. TOXICOLOGICAL INFORMATION

The following results are for the product along with results on the active substances.

ACUTE ORAL TOXICITY :

Species	LD50	Test Descriptor
Rat	3,810 mg/kg	Product

Rating : Non-Hazardous

ACUTE DERMAL TOXICITY :

Species	LD50	Test Descriptor
Rabbit	> 5,000 mg/kg	Product

Rating : Non-Hazardous

ACUTE INHALATION TOXICITY :

Species	LC50	Test Descriptor
Rat	13.7 mg/l (4 hrs)	Product

Rating : Toxic

PRIMARY SKIN IRRITATION : A 1.5% active solution is corrosive to skin, a 0.6% active solution is a severe skin irritant, a 0.3% active solution is a moderate skin irritant and a 0.06% active solution is a non-irritant.

PRIMARY EYE IRRITATION : A 1.5% active solution is corrosive to the eyes, a 0.3% active solution is an eye irritant and 0.06% active solution is a non-irritant.

SENSITIZATION :
Repeated or prolonged contact may cause sensitization in some individuals. A Guinea pig (Buehler Technique) sensitization study with an induction dosage of 90 ppm of active ingredients followed by an insult of 429 ppm of active ingredients was positive. A human repeated insult patch study of 28 ppm active ingredients followed by an insult of 56 ppm of active ingredients resulted in no effect to the subjects tested.

CHRONIC TOXICITY DATA :
A 90-day dietary study in dogs of 840 ppm of isothiazolinone resulted in no mortalities or pathological findings. A 90-day dermal study in rabbits of 0.4 mg/kg/day of isothiazolinone resulted in irritation but no pathological effects. A 30-month skin painting study with mice using 400 ppm isothiazolinone three times per week showed no increased tumor frequency over control. A teratology study with rabbits and rats was negative using dosages of 1.5 to 15 mg/kg isothiazolinone. Mutagenicity results have been equivocal.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product along with results on the active substances.

ACUTE FISH RESULTS :

Species	Exposure	LC50	Test Descriptor
Sheepshead Minnow	96.00 hrs	32.000 mg/l	Product
Bluegill Sunfish	96 hrs	18.67 mg/l	Product
Fathead Minnow	144 hrs	8 mg/l	Product
Rainbow Trout	96 hrs	12.67 mg/l	Product
Inland Silverside	96 hrs	16.62 mg/l	Product

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Mysid Shrimp (Mysidopsis bahia)	96.00 hrs	18.000 mg/l		Product
Ceriodaphnia dubia	48 hrs	15 mg/l		Product
Daphnia magna	48 hrs	8.7 - 12 mg/l		Product
Blue Mussel	48 hrs	865 mg/l		Product
American Oyster	48 hrs	1,730 mg/l		Product

AVIAN RESULTS :

Species	Exposure	LC50	Test Descriptor
Bobwhite Quail	8 Days	> 60 mg/kg > 560 ppm	

PERSISTENCY AND DEGRADATION :

Total Organic Carbon (TOC) : 7,850 mg/l

Chemical Oxygen Demand (COD) : 20,000 mg/l

The degradation of the major active substance begins with ring opening and elimination of chloride ion. Degradation leads to the formation of a variety of small organic acids, methylamine, carbon dioxide and elemental sulfur. The half life of each active substance is dependent upon the initial concentration.

MOBILITY :
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM , provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

Metal Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or other procedures approved by state and local authorities. Plastic Containers: ^PLASTIC CONTAINERS: Do not reuse empty container. Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s) :	ISOTHIAZOLINONE MICROBIOCIDE
UN/ID No :	UN 3265
Hazard Class - Primary :	8
Packing Group :	II
Flash Point :	None

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s) :	ISOTHIAZOLINONE MICROBIOCIDE
UN/ID No :	UN 3265
Hazard Class - Primary :	8
Packing Group :	II
IATA Cargo Packing Instructions :	812
IATA Cargo Aircraft Limit :	30 L (Max net quantity per package)

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Technical Name(s) :	ISOTHIAZOLINONE MICROBIOCIDE
UN/ID No :	UN 3265
Hazard Class - Primary :	8

Packing Group : II

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

5-Chloro-2-Methyl-4-Isothiazolin-3-one : Corrosive, Sensitizer
2-Methyl-4-Isothiazolin-3-one : Corrosive, Sensitizer
Magnesium Nitrate : Eye irritant

CERCLA/SUPERFUND, 40 CFR 117, 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
X	Delayed (Chronic) Health Hazard
-	Fire Hazard
-	Sudden Release of Pressure Hazard
-	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product contains the following substance(s), (with CAS # and % range) which appear(s) on the List of Toxic Chemicals

Hazardous Substance(s)	CAS NO	% (w/w)
Magnesium Nitrate	10377-60-3	1.0 - 5.0

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
This product is exempted under TSCA and regulated under FIFRA. The inerts are on the Inventory List.

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under : 21 CFR 176.300 Slimicides 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods. 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods.

The following limitations apply:

Maximum dosage	Limitation
FOR 176.300: 0.125% (ACTIVES)	of dry weight fiber
FOR 176.170/180: 1675 PPM	as an antimicrobial agent for finished coating formulations and for additives used in the manufacture of paper and paperboard, including fillers, binders, pigment sluries and sizing solutions
FOR 176.170/180: 3350 PPM	as an antimicrobial agent for polymer latex emulsions in paper coatings

NSF NON-FOOD COMPOUNDS REGISTRATION PROGRAM (former USDA List of Proprietary Substances & Non-Food Compounds) :
NSF Registration number for this product is : 062419
This product is acceptable for treating boilers, steam lines, and/or cooling systems (G7) where neither the treated water nor the steam produced may contact edible products in and around food processing areas.

FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT (FIFRA) :
EPA Reg. No. 1706-153
In all cases follow instructions on the product label.

This product has been certified as KOSHER/PAREVE for year-round use INCLUDING THE PASSOVER SEASON by the CHICAGO RABBINICAL COUNCIL.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
This product contains the following substances listed in the regulation:

Substance(s)	Citations
• Cupric Nitrate	Sec. 307, Sec. 311

CLEAN AIR ACT, Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
None of the substances are specifically listed in the regulation.

CALIFORNIA PROPOSITION 65 :
This product does not contain substances which require warning under California Proposition 65.

MICHIGAN CRITICAL MATERIALS :
This product contains the following substances listed in the regulation:

Copper

STATE RIGHT TO KNOW LAWS :
The following substances are disclosed for compliance with State Right to Know Laws:

Copper	7440-50-8
Magnesium Nitrate	10377-60-3

NATIONAL REGULATIONS, CANADA :

WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS CLASSIFICATION :
Pesticide controlled products are not regulated under WHMIS.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

INTERNATIONAL CHEMICAL CONTROL LAWS

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Ministry of International Trade & industry List (MITI).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

THE PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippine Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Moderate

* The environmental risk is: Moderate

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

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The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 04/26/2006
Version Number : 1.16

MATERIAL SAFETY DATA SHEET

PRODUCT

VISCO 3967 GLUT/AMINE

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : **VISCO 3967 GLUT/AMINE**

COMPANY IDENTIFICATION : Nalco Energy Services, L.P.
P.O. Box 87
Sugar Land, Texas
77487-0087

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 3 / 3 FLAMMABILITY : 1 / 1 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Glutaraldehyde	111-30-8	10.0 - 30.0
Benzyl-Dimethyl-Tetradecyl-Ammonium Chloride	139-08-2	1.0 - 5.0

3. HAZARDS IDENTIFICATION

****EMERGENCY OVERVIEW****

DANGER
Corrosive. May cause tissue damage. May cause sensitization by skin contact. Toxic to aquatic organisms. KEEP OUT OF REACH OF CHILDREN Corrosive. Causes irreversible eye damage. Causes skin irritation. Harmful if inhaled. Harmful if swallowed. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Causes asthmatic signs and symptoms in hyper-reactive individuals. Do not get in eyes, on skin, on clothing. Avoid breathing vapor. Do not swallow. Wear goggles, protective clothing, and rubber gloves. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Keep container tightly closed and in a well-ventilated place. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water.
Wear a face shield. Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots.
Not flammable or combustible. May evolve oxides of carbon (COx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :
Corrosive. Will cause eye burns and permanent tissue damage.

SKIN CONTACT :
May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered. Repeated or prolonged contact may cause skin sensitization.

INGESTION :
Not a likely route of exposure. Corrosive; causes chemical burns to the mouth, throat and stomach.

INHALATION :
Not a likely route of exposure. Irritating, in high concentrations, to the eyes, nose, throat and lungs.

SYMPTOMS OF EXPOSURE :
Acute :
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic :
A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS :
A review of available data does not identify any worsening of existing conditions.

4. FIRST AID MEASURES

EYE CONTACT :
PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT. Immediately flush eye with water for at least 15 minutes while holding eyelids open. Get immediate medical attention.

SKIN CONTACT :
Immediately flush with plenty of water for at least 15 minutes. For a large splash, flood body under a shower. Remove contaminated clothing. Wash off affected area immediately with plenty of water. Get immediate medical attention. Contaminated clothing, shoes, and leather goods must be discarded or cleaned before re-use.

INGESTION :
DO NOT INDUCE VOMITING. If conscious, washout mouth and give water to drink. Get immediate medical attention.

INHALATION :
Remove to fresh air, treat symptomatically. Get medical attention.

IF IN EYES: Immediately flush with plenty of water for at least 15 minutes. Get immediate medical attention.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention.

IF INHALED: Remove to fresh air. If breathing is difficult, administer oxygen. If symptoms persist, call a physician.

IF SWALLOWED: DO NOT INDUCE VOMITING. Do not give anything to drink. Seek medical advice with urgency., NOTE TO PHYSICIAN: Aspiration may cause lung damage. Probable mucosal damage may contraindicate the use of gastric lavage.

NOTE TO PHYSICIAN :
Probable mucosal damage may contraindicate the use of gastric lavage. Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT : Not applicable

EXTINGUISHING MEDIA :
Not expected to burn. Use extinguishing media appropriate for surrounding fire.

FIRE AND EXPLOSION HAZARD :
Not flammable or combustible. May evolve oxides of carbon (COx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS :
Restrict access to area as appropriate until clean-up operations are complete. Ensure clean-up is conducted by trained personnel only. Ventilate spill area if possible. Do not touch spilled material. Stop or reduce any leaks if it is safe to do so. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP :
SMALL SPILLS: Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. LARGE SPILLS: Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Wash site of spillage thoroughly with water. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS :
This product is toxic to fish and other water organisms. Do not discharge directly into lakes, ponds, streams, waterways or public water supplies.

7. HANDLING AND STORAGE

HANDLING :
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid generating aerosols and mists. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available.

STORAGE CONDITIONS :
Store the containers tightly closed. Store separately from oxidizers. Store in suitable labelled containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS :
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

ACGIH/TLV :
Substance(s)

Glutaraldehyde	CEILING: 0.05 ppm , 0.2 mg/m3 0.05 ppm , 0.2 mg/m3

OSHA/PEL :
Substance(s)

Glutaraldehyde	CEILING: 0.2 ppm , 0.8 mg/m3

ENGINEERING MEASURES :
General ventilation is recommended. Use local exhaust ventilation if necessary to control airborne mist and vapor.

RESPIRATORY PROTECTION :
If significant mists, vapors or aerosols are generated an approved respirator is recommended. A dust, mist, fume cartridge may be used. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

HAND PROTECTION :
Nitrile gloves, Neoprene gloves, PVC gloves, Rubber gloves, Butyl gloves

SKIN PROTECTION :
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

EYE PROTECTION :
Wear a face shield with chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Eye wash station and safety shower are necessary. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Liquid
APPEARANCE	Clear
ODOR	Characteristic

SPECIFIC GRAVITY	1.03 @ 68 °F / 20 °C
DENSITY	8.56 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	3.1 - 4.5
FREEZING POINT	26 °F / -3.2 °C
BOILING POINT	212 °F / 100 °C

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY :
Stable under normal conditions.

HAZARDOUS POLYMERIZATION :
Hazardous polymerization will not occur.

CONDITIONS TO AVOID :
Freezing temperatures.

MATERIALS TO AVOID :
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS :
Under fire conditions: Oxides of carbon

11. TOXICOLOGICAL INFORMATION

The following results are for the active components.

ACUTE ORAL TOXICITY :

Species	LD50	Test Descriptor
Rat	1.3 ml/kg	50% Active Ingredient Glutaraldehyde
Rat	1.2 ml/kg	45% Active Ingredient Glutaraldehyde
Rat	1.54 - 1.87 ml/kg	25% Active Ingredient Glutaraldehyde
Rat	1.07 - 1.62 ml/kg	10% Active Ingredient Glutaraldehyde

Rating : Non-Hazardous

ACUTE DERMAL TOXICITY :

Species	LD50	Test Descriptor
Rabbit	1.59 - 2.54 ml/kg	50% Active Ingredient Glutaraldehyde
Rabbit	2.00 - 2.71 ml/kg	45% Active Ingredient Glutaraldehyde
Rabbit	8.0 - 12.80 ml/kg	25% Active Ingredient Glutaraldehyde

Rating : Non-Hazardous

ACUTE INHALATION TOXICITY :

Species	LC50	Test Descriptor
Rat	> 2.5 l/minute ()	Hazardous component Glutaraldehyde

Rating : Toxic

PRIMARY SKIN IRRITATION : At 10% or greater, glutaraldehyde solutions may cause moderate to severe irritation, with possible necrosis after prolonged contact.

PRIMARY EYE IRRITATION : At levels of 0.2% and below of glutaraldehyde, no eye irritation was noted. Levels above 0.2% of glutaraldehyde produced moderate to severe irritation and corneal injury.

SENSITIZATION :
Repeated or prolonged contact may cause sensitization in some individuals.

CHRONIC TOXICITY DATA :
Glutaraldehyde incorporated into the diet of rats up to 1.6 g/kg for seven days resulted in no deaths. An eleven week drinking water study of glutaraldehyde at up to 0.5% showed no effect.

CARCINOGENICITY :
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :
Based on our hazard characterization, the potential human hazard is: High

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the hazardous components.

ACUTE FISH RESULTS :

Species	Exposure	LC50	Test Descriptor
Bluegill Sunfish	96 hrs	37.6 mg/l	25% Active Ingredient (Glutaraldehyde)
Rainbow Trout	96 hrs	42.1 mg/l	25% Active Ingredient (Glutaraldehyde)

Rating : Essentially non-toxic

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Daphnia magna	48 hrs	16.9 mg/l		25% Active Ingredient (Glutaraldehyde)
Green Crab	96 hrs	465 mg/l		25% Active Ingredient
Grass Shrimp	96 hrs	41 mg/l		25% Active Ingredient

Rating : Essentially non-toxic

AQUATIC MICROORGANISM RESULTS :

Species	Exposure	EC50/LC50	Test Descriptor
Sewage Microorganisms	96 hrs	34 mg/l	Active Substance

AVIAN RESULTS :

Species	Exposure	LC50	Test Descriptor
Bobwhite Quail	8 Days	10,000 ppm	25% Active Ingredient
Mallard Duck	8 Days	10,000 ppm	25% Active Ingredient
Mallard Duck		933 mg/kg	50% Active Ingredient
Mallard Duck		1,631 mg/kg	25% Active Ingredient

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: High

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : AVIATION REGULATED LIQUID, N.O.S.
Technical Name(s) : GLUTARALDEHYDE
UN/ID No : UN 3334
Hazard Class - Primary : 9
Packing Group : N/A
IATA Cargo Packing Instructions : 906
IATA Cargo Aircraft Limit : 220 L (Max net quantity per package)

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name :	PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Glutaraldehyde : Corrosive, Sensitizer
Benzyl-Dimethyl-Tetradecyl-Ammonium Chloride : Corrosive

CERCLA/SUPERFUND, 40 CFR 117, 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
X	Delayed (Chronic) Health Hazard
-	Fire Hazard
-	Sudden Release of Pressure Hazard
-	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
None of the substances are specifically listed in the regulation.

CLEAN AIR ACT, Sec. 111 (40 CFR 60, Volatile Organic Compounds), Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
None of the substances are specifically listed in the regulation.

CALIFORNIA PROPOSITION 65 :
This product does not contain substances which require warning under California Proposition 65.

MICHIGAN CRITICAL MATERIALS :
None of the substances are specifically listed in the regulation.

STATE RIGHT TO KNOW LAWS :
The following substances are disclosed for compliance with State Right to Know Laws:

Glutaraldehyde	111-30-8

NATIONAL REGULATIONS, CANADA :

WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS CLASSIFICATION :
E - Corrosive Material

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

INTERNATIONAL CHEMICAL CONTROL LAWS

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS) and are listed on the Australian Inventory of Chemical Substances (AICS).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Ministry of International Trade & industry List (MITI).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

THE PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippine Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

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Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

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Ariel Insight# (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

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Prepared By : Product Safety Department
Date issued : 02/21/2004
Version Number : 1.2

APPENDIX 10

STIG-1 Well Installation History and Geophysical Logs

COMPLETION AND TESTING OF NCPA LODI STIG #1 INJECTION WELL

August 1993

Prepared for

NORTHERN CALIFORNIA POWER AGENCY
P. O. Box 663
Middletown, CA 95461
(707) 987-3101

by

MESQUITE GROUP, INC.
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Fullerton, CA 92632
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COMPLETION AND TESTING OF
NCPA LODI STIG #1 INJECTION WELL

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COMPLETION AND TESTING OF
NCPA Lodi STIG #1 Injection Well
May 12 - June 9, 1993

1.0 SUMMARY

Drilling operations on NCPA Lodi STIG #1 injection well were completed on May 9, 1993. The well was drilled to a total depth of 4,650 ft, with 7-in. casing cemented at 3,660 ft in the Nortonville Shale (the confining layer) and a 5-in. liner cemented through the Domengine formation to a depth of 4,645 ft in the Capay Shale. During the period May 12 - June 9, 1993, the following operations were carried out to complete and test the well.

- The 5-in. liner was perforated selectively in sands in the lower portion of the Domengine formation. A net 222 ft of perforations were shot within the interval 4,234 - 4,573 ft.

- The well was produced by nitrogen lift through coil tubing to clean out sand fill, collect representative water samples from the Domengine formation and to provide formation water for an injection test.

- A wire-wrapped screen liner was installed and gravel-packed inside the 5-in. liner for sand control.

- An injection test was performed in conjunction with cased-hole logging to quantify injectivity, determine the formation transmissivity, define the injection profile and verify that there is no interzonal flow behind casing.

- A packer and 4½-in. tubing were installed in the well and pressure tested.

The completion in the lower portion of the Domengine was successful, leaving sands above 4,166 ft available for future recompletion. Representative Domengine water samples were collected during production of the well, and the total dissolved solids content was determined to be 14,066 mg/l. Injection test results indicated capacity adequate for water disposal at the nominal design rate of 150 gpm with a wellhead pressure of about 265 psig.

Temperature, tracer and noise logs confirmed that the well has good mechanical integrity, with no movement of injected water above the completion interval and no other interzonal flow.

Included in this report is the analysis of a leak-off test which was performed in the confining layer (Nortonville shale) at the shoe of the 7-in. casing during drilling operations. The formation was tested at pressures up to an equivalent gradient of 0.65 psi/ft with no indication of formation breakdown. The leakoff test was terminated before reaching breakdown pressure, so the results did not define an upper limit on injection pressure. Based on other test results in the Nortonville and an appropriate "safety factor", a recommended maximum injection wellhead pressure of 975 psig was derived.

2.0 INTRODUCTION

This report documents completion and testing activities of the NCPA Lodi STIG #1 injection well. The well is intended for disposal of waste water from a steam injection gas turbine power plant which NCPA plans to build near the City of Lodi's White Slough Water Pollution Control Facility. The nominal design injection capacity requirement is for 150 gpm of waste water from the power plant.

NCPA's objective for the well was to perforate and test sands in the lower portion of the Domengine formation and retain the option to perforate sands in the upper portion when and if the additional completion interval might be required for adequate injection capacity.

3.0 TEMPERATURE LOG AND PERFORATING

On May 12, a shut-in temperature log and a gamma ray/casing collar locator (GR/CCL) correlation log were run. Depths of collars were correlated to the Halliburton Logging Services (HLS) openhole log run on May 7, 1993, and the 5-in. liner was perforated selectively in sands between the depths of 4,234 ft and 4,573 ft. The perforating was done with 11-gram jet charges at 4 shots/ft, 120° phasing, in 3⅛-in. hollow steel carrier guns. By API test, these charges produce nominal 0.31-in. diameter holes with 18.9 inches of penetration. The perforating was done on May 12 and 13. The following intervals were perforated: (depths referenced to the HLS openhole log)

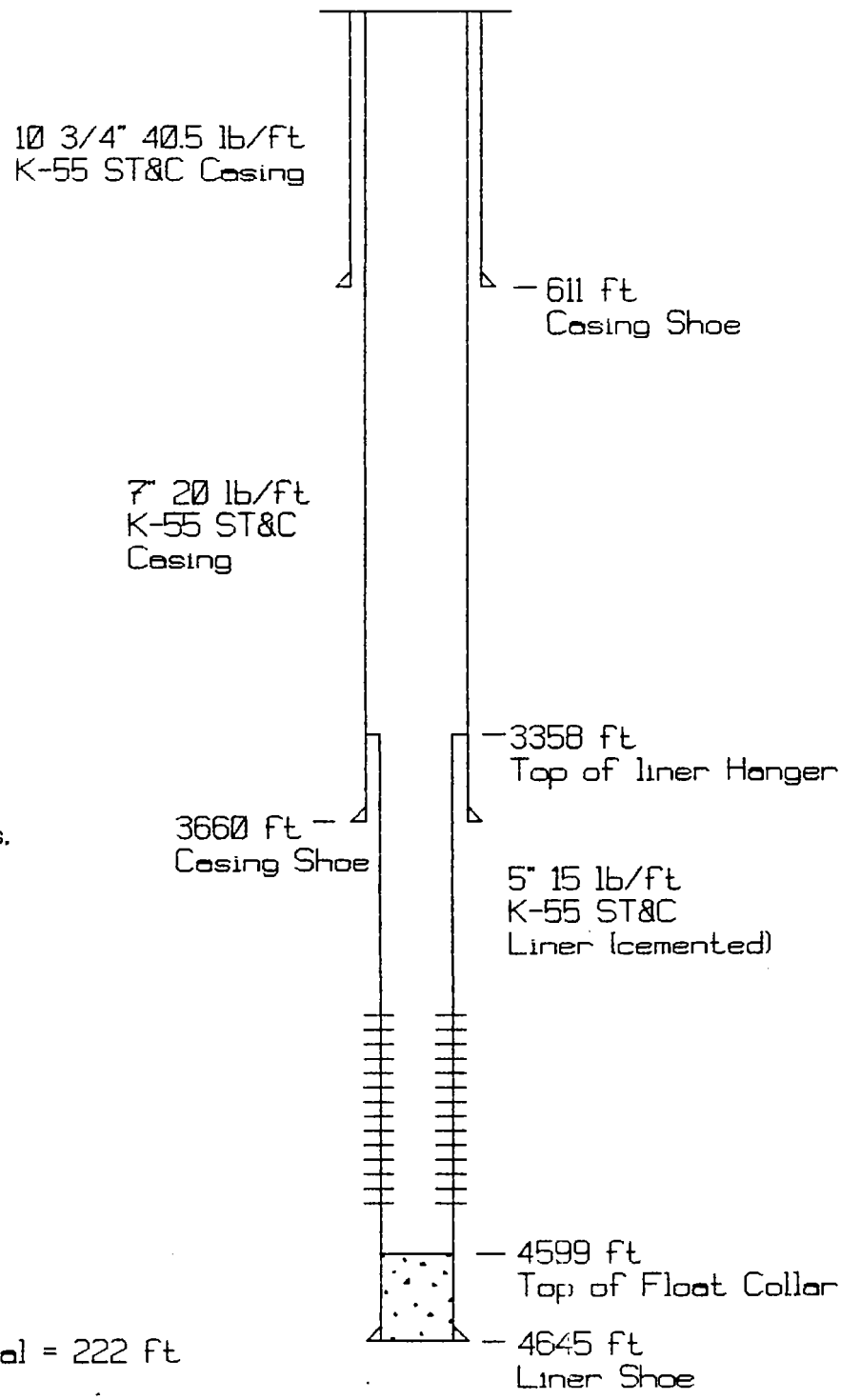
4,234 - 4,239	4,331 - 4,379
4,244 - 4,254	4,390 - 4,411
4,267 - 4,288	4,432 - 4,507
4,296 - 4,306	4,528 - 4,538
4,312 - 4,326	4,567 - 4,573

A diagram of the well as it was at the completion of perforating is shown in Figure 3.1.

The first indication of a sand control problem occurred during the perforating. Sand fill was running into the wellbore during the perforating job and accumulated to a depth of 4,311 ft by the end of the job. At one point, sand fill precluded perforating one 21-ft interval (4,411 - 4,432 ft) of a major sand body.

Figure 3.1

Casing Diagram
NCPA Lodi STIG #1 Injection Well
May 13, 1993 After Perforating



Perforations:

4 jet shots/ft, 0.31-in. holes.

120° phasing

4,234 - 4,239
4,244 - 4,254
4,267 - 4,288
4,296 - 4,306
4,312 - 4,326
4,331 - 4,379
4,390 - 4,411
4,432 - 4,507
4,528 - 4,538
4,565 - 4,573

Total net perforated interval = 222 ft

* Depths are based on HLS open hole logs dated 5/2/93 and 5/7/93

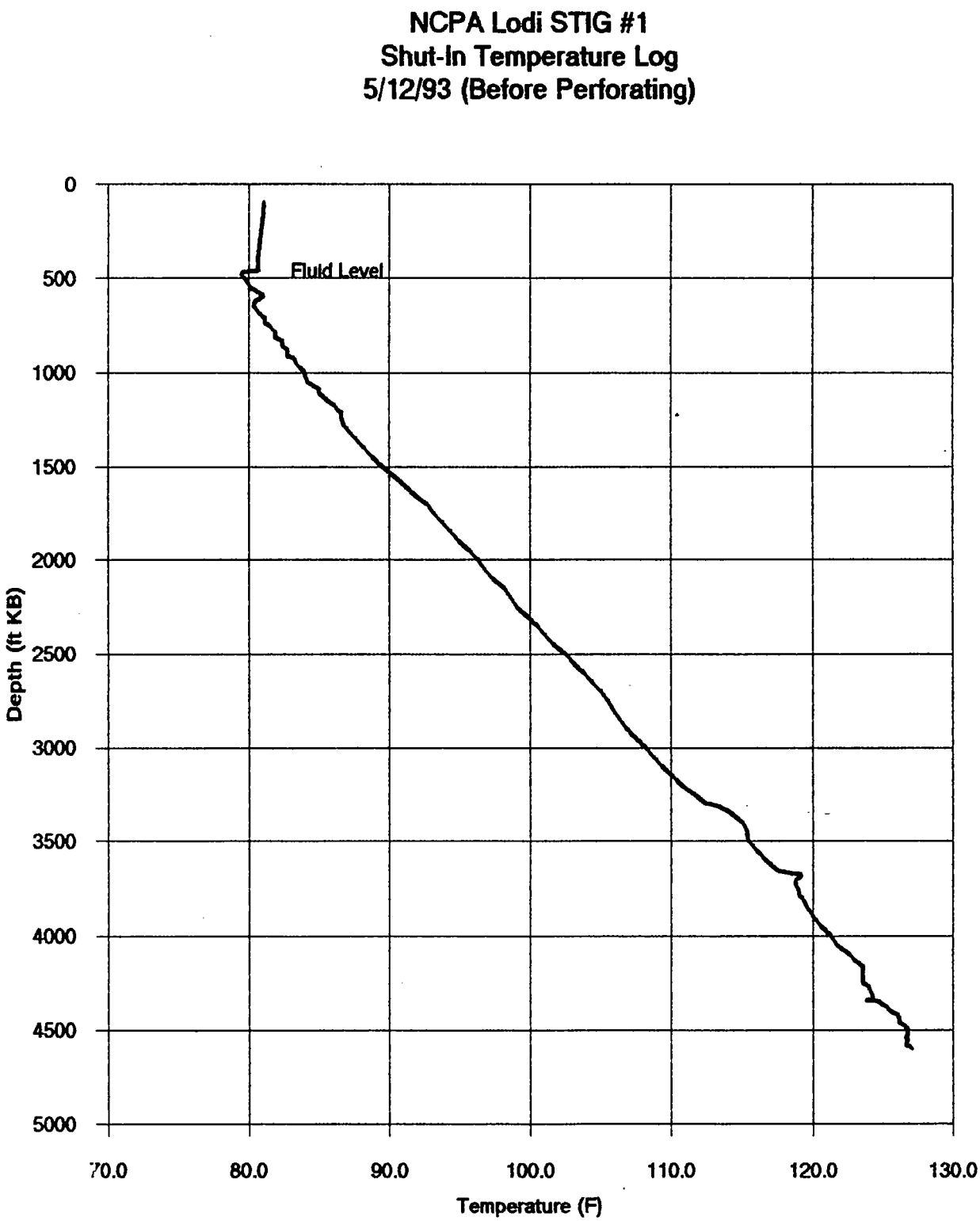
The shut-in temperature log is included in Appendix A, and a compressed plot of the log is shown in Figure 3.2. The log was run after the wellbore fluid had been static for about 73 hours following a change over from mud to a six percent potassium chloride completion fluid. The temperature profile is normal, although there are some small anomalies which are apparent residuals of drilling fluid invasion. There are no indications of interzonal flow, which would be characterized by a smooth, isothermal (or nearly isothermal) interval in the profile.

4.0 CLEANOUT AND PRODUCTION BY NITROGEN LIFT

It was originally planned that after perforating, the well would be produced for water samples using an electric submersible pump. However, because of the running sand problem, it was clear that a pump would not work. Instead, the sand was cleaned out and the well was produced for samples in a combined operation using nitrogen injection through coil tubing. This was done on May 15.

Nitrogen was injected at rates of 300 to 400 scfm through 1½-in. coil tubing to produce the well by gas lift and to clean out the sand. Production (returns) from the well were piped from the tubing head side outlet valves to the rig's shale shaker and mud tank. During the nitrogen lift operation, water was transferred from the mud tank to a 500-barrel temporary holding tank from which it was pumped, filtered and transferred to three clean 500-barrel tanks. The filtered formation water was stored in the clean tanks for an injection test to be done later. During the cleanout and production operation, the four 500-barrel tanks were gauged periodically to determine the volume of water produced and the flow rate between gaugings. Water

Figure 3.2


NCPA Lodi STIG #1
Shut-In Temperature Log
5/12/93 (Before Perforating)
Fluid Level
Depth (ft KB)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
70.0
80.0
90.0
100.0
110.0
120.0
130.0
Temperature (F)

production data and other information are given in Table 4.1. As shown in the table, 56,280 gallons of water were produced in 13 hours. This is equivalent to 8.4 wellbore volumes.

Early in the cleanout and production operation, large quantities of sand were produced from the wellbore and formation, but during the last five hours, the produced water was clear and essentially sand-free. This decline of sand production was probably due to the formation of sand bridges in the perforations during the relatively stable flow of the last few hours.

Sand produced from the well was very clean and completely unconsolidated. Samples were collected for size distribution analysis because it appeared likely that this information would be needed for sand control design.

5.0 FORMATION WATER CHEMISTRY

Samples of the Domengine formation water were collected on May 15, 1993, during the production of the well. Periodic samples were monitored in the field by three techniques to verify that the water chemistry was stable before collecting a complete suite of samples for laboratory analyses. The monitoring techniques and results are shown in Table 5.1.

At 2030 hrs on May 15, the well had produced 42,840 gallons of water (6.4 wellbore volumes), and field measurements indicated the water chemistry had been stable for at least two hours. Beginning at this time, a suite of ten samples was collected for laboratory analyses by methods listed in Table 5.2. All sample bottles were washed in 10 percent (by volume) nitric acid and rinsed in deionized water before sampling. All samples except the one for phosphate analysis were stored in ice during transport to the analytical laboratory. The phosphate sample

TABLE 4.1
NCPA Lodi STIG #1
Cleanout and Production by Nitrogen Lift
15-May-93

Time	Coil Tbg Depth (ft KB)	Nitrogen Rate (scfm)	Tbg Head Pressure (psig)	Average Wtr Prod Rate* (gpm)	Cumulative Water Produced** (gallons)	Comments
09:30	0	0	0	0	0	Displace tbg w/ wtr
09:38	450	0	0			Stopped RIH
09:40	450	0	0			End displacement
09:42	450	300	0			Start Nitrogen
09:43	450	300	0			Start RIH coil tbg
09:47	700	300	0			Well unloading wtr
09:50	900	300	0			Well unloading wtr
09:54	1120	300	0			Well unloading wtr
09:55	1175	300	0			N2 @ btm of tbg
10:00	1442	300	0			Well unloading wtr
10:10	1442	300	0	22	860	Producing 63 gpm
10:14	1442	300	0			Producing 105 gpm
10:15	1442	300				First N2 in returns
10:25	1785	300	175			48/64 choke
10:35	2220	300	55			
10:45	2650	300	0			Producing 32 gpm
10:46	2695	400				Incr N2 rate
10:53	3000	400	50			Producing 42 gpm
11:03	3363	400	25	34	2,646	
11:10	3570	400	0			Low prod rate
11:25	4060	400				
11:35	4250	400	60			Wtr flow increased
11:40	4320	400	20			Producing 52 gpm
12:01	4370	400				
12:05	4370	400	50			
12:18	4420	400				
12:23	4420	400	250			Producing fine sand
12:35	4470	400	200			
12:39	4470	400		42	6,636	
12:54	4520	400				
13:07	4520	400	250			Prod coarser sand
13:13		400	225			RIH with CT
13:15	4564	400				CT on hard fill
13:25	4564	400		38	8,400	Sand cut out Chksn
13:50	4564	400				Pmpd wtr, c/o fill
14:00	4590	400				C/O to 4590' (FC?)
14:04	4590	400	250			No choke on rtns
14:10	4590	400			9,282	
14:45	4585	400	50	76	11,928	Producing fine sand
15:35	4585	400	250			Sand coarse & fine
15:55	4585	400	200			Sand prod decrsng.
16:00	4585	400				Start filtering wtr
16:10	4585	400	200			Sand coarse & fine

TABLE 4.1

NCPA Lodi STIG #1

Cleanout and Production by Nitrogen Lift

15-May-93

Time	Coil Tbg Depth (ft KB)	Nitrogen Rate (scfm)	Tbg Head Pressure (psig)	Average Wtr Prod Rate* (gpm)	Cumulative Water Produced** (gallons)	Comments
16:20	4585	400		87	20,160	
17:30	4585	370	200	92	26,628	Very little sand
	4585					Steady prod rate
18:15	4585	370	200		30,198	Clear wtr, no sand
18:40	4585	370	200	89	32,886	Clear wtr, no sand
18:42	4585	370			33,390	Clear wtr, no sand
19:31	4585	370		105	38,220	Clear wtr, no sand
20:00	4585	370	200			Clear wtr, no sand
20:20	4585	370	200	75	41,874	Clear wtr, no sand
21:30	4585	370	175	90	48,174	Clear wtr, no sand
22:00	4585	370				Shut off N2. Start POH.
22:22		0	100			
22:30		0	90			
22:36		0	100			
22:38		0	250			
22:41		0	70			
22:43		0	30			
22:50		0				Well almost dead
23:00		0	0	90	56,280	Shut in well

* Average water production rate between tank gaugings. Some fluctuations in the production rate values are attributable to the fact that variations in the volume of water in the rig's mud tank were not accounted for.

** Cumulative volume of water produced based on gaugings of 500-bbl tanks.

Table 5.1

CHEMICAL MEASUREMENTS DURING FLOW

NCPA Lodi STIG #1

May 15, 1993

(FORMATION WATER)

Time *(hrs)*	Temperature *(°F)*	TDS* *(mg/l)*	Cl** *(mg/l)*	pH
1100		59,500		
1138		59,500		9.4
1227		12,500		8.1
1305		13,000	6,600	8.3
1352	102	13,500	6,840	8.4
1426	101	14,000	6,877	8.7
1523	106.5	18,200	9,500	8.5
1554	107.2	14,500	7,161	8.3
1629	107.0	14,000	6,806	8.3
1703	107.7	13,500	6,771	8.3
1737	108.3	14,000	6,842	8.3
1806	108.5	14,000	6,789	8.3
1838	108.7	13,500	6,789	8.3
1925	108.8	13,500	6,789	8.2
1957	109.0	13,500	6,789	8.2
2027	109.1	13,500	6,789	8.2

*By electrical conductivity
**By silver nitrate titration

Table 5.2

SAMPLE METHODS

NCPA Lodi STIG #1

May 15, 1993

(FORMATION WATER)

Sample	Analyte	Sample Size *(ml)*	Container	Filtered *(0.45 micron)*	Preservative
NCPA AS	Asbestos	500	glass	no	none
NCPA CO	Coliform	250	plastic	no	0.1 ml of 10% $Na_2S_2O_2$
NCPA B	Aluminum, Arsenic, Antimony, Barium, Beryllium, Boron, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, Zinc, Silica	500	plastic	yes	2 ml HNO_3
NCPA A	Nitrate, Chloride, Sulfate	500	plastic	no	none
NCPA CA	Carbonate, Bicarbonate	250	plastic	no	no head space
NCPA P	Phosphate	250	plastic	no	none
NCPA C	Calcium, Magnesium, Potassium, Sodium	500	plastic	yes	2 ml HNO_3
NCPA CY	Cyanide	500	plastic	no	0.6 g ascorbic acid, pH ~ 12.2 with NaOH
NCPA TDS	Total Dissolved Solids, pH, EC, Specific Gravity, Total Suspended Solids	500	plastic	no	none
NCPA OG	Oil and Grease	500	plastic	no	none

was kept frozen on dry ice during transport. The samples were analyzed by methods listed in Table 5.3.

On May 16, a composite sample suite of water was collected from the three storage tanks. This was done to provide NCPA with a record of the chemistry of the water which was later injected. The sampling, preservation and analysis techniques were similar to those for the formation water samples.

Analytical results for the formation water are listed in Table 5.4, and the laboratory reports are included in Appendix B. As shown in the table, the total dissolved solids content of the Domengine water was determined to be 14,066 mg/l. The laboratory analytical reports in Appendix B list results for both the produced formation water and the composite injection water samples. Sample ID's for the formation water samples end in the number "1" and ID's for the injection water end in the letter "I".

6.0 CONFIRMATION OF SAND CONTROL PROBLEM

Although there had been a problem with running sand during perforating, it appeared that the sand had stabilized during the last five hours of the cleanout and production operation. Therefore, on May 16 operations were begun to run a shut-in temperature log and perform an injection test, with no further attention to the sand problem. Logging tools were run in the hole, but they stopped on apparent sand fill at 4,108 ft (126 ft above the top perforation). Halliburton filled the hole with water and pressured up to 450 psig on the wellhead, and it was confirmed that the plug was solid and the well would not take water. The scheduled injection test was then postponed pending resolution of the sand control problem.

Table 5.3

ANALYTICAL METHODS

NCPA Lodi STIG #1

May 15, 1993

(FORMATION WATER)

Sample	Analyte	EPA Method	Detection Limit
NCPA AS	Asbestos	600/4-83	0.09 MSL
NCPA CO	Coliform	Standard	
NCPA B	Aluminum	200.7	0.20 mg/l
	Arsenic	206.3	0.005 mg/l
	Antimony	200.7	0.10 mg/l
	Barium	200.7	0.01 mg/l
	Beryllium	200.7	0.01 mg/l
	Boron	200.7	0.01 mg/l
	Cadmium	200.7	0.01 mg/l
	Chromium	200.7	0.05 mg/l
	Copper	200.7	0.05 mg/l
	Iron	200.7	0.01 mg/l
	Lead	200.7	0.01 mg/l
	Manganese	200.7	0.01 mg/l
	Mercury	245.1	0.005 mg/l
	Nickel	200.7	0.01 mg/l
	Selenium	270.3	0.005 mg/l
	Silver	200.7	0.01 mg/l
	Thallium	200.7	0.01 mg/l
	Zinc	200.7	0.01 mg/l
	Silica	200.7	1.0 mg/l
NCPA A	Nitrate	353.2	5.0 mg/l
	Chloride	325.3	1.0 mg/l
	Sulfate	375.4	0.5 mg/ml
NCPA CA	Carbonate	310.1	1.0 mg/l
	Bicarbonate	310.1	1.0 mg/l
NCPA P	Phosphate	365.3	0.1 mg/l
NCPA C	Calcium	200.7	0.01 mg/l
	Magnesium	200.7	0.02 mg/l
	Potassium	200.7	0.20 mg/l
	Sodium	200.7	1.0 mg/l
NCPA CY	Cyanide	335.2	0.1 mg/l
NCPA TDS	Total Dissolved Solids	160.3	5 mg/l
	pH	150.1	
	EC	120.1	
	Specific Gravity		
	Total Suspended Solids	160.2	5 mg/l
NCPA OG	Oil and Grease	413.2	2.5 mg/l

Table 5.4

CHEMICAL ANALYSES

DOMENGINE FORMATION WATER

SAMPLE TYPE: Domengine Formation Water
WELL: NCPA Lodi STIG #1
COLLECTION DATE: 5/15/93
SAMPLE TIME: 2100 hrs
SAMPLE POINT: Flow line
SAMPLE METHOD: Grab

WHT: 109.1°F
Flow Rate: 97 gpm

Analyses

TDS	14,066 mg/l
pH	7.85
EC	17,780 μ mhos/cm
Specific Gravity	1.0004
TSS	19 mg/l
Ca	761 mg/l
Mg	86 mg/l
K	46 mg/l
Na	3200 mg/l
Al	<0.20 mg/l
As	<0.005 mg/l
Sb	0.12 mg/l
Ba	1.59 mg/l
Be	<0.01 mg/l
B	9.0 mg/l
Cd	<0.01 mg/l
Cr	<0.05 mg/l
Cu	<0.05 mg/l
Fe	<0.01 mg/l
Pb	<0.01 mg/l
Mn	0.26 mg/l
Hg	<0.005 mg/l
Ni	<0.01 mg/l
Cyanide	<0.1 mg/l
Se	<0.005 mg/l
Ag	<0.01 mg/l
Tl	<0.01 mg/l
Zn	<0.01 mg/l
SiO_2	16.5 mg/l
NO_3	14 mg/l
Cl	7000 mg/l
SO_4	8.0 mg/l
CO_3	<1.0 mg/l
HCO_3	62 mg/l
PO_4	0.08 mg/l
Asbestos	<0.09 MSL
Coliform	<1.1 MPN/100 ml
Oil and Grease	<2.5 mg/l

7.0 SAND CONTROL DESIGN AND GRAVEL PACK

It is considered likely that the sand fill discovered on May 16 was produced into the wellbore and carried up the hole during the final minutes of flow on the previous day, after nitrogen injection had been shut off and the well was surging. Considering this and the earlier problem with running sand, it was decided that some form of sand control would be necessary to stop the sand influx, even with the well in injection service.

7.1 Design

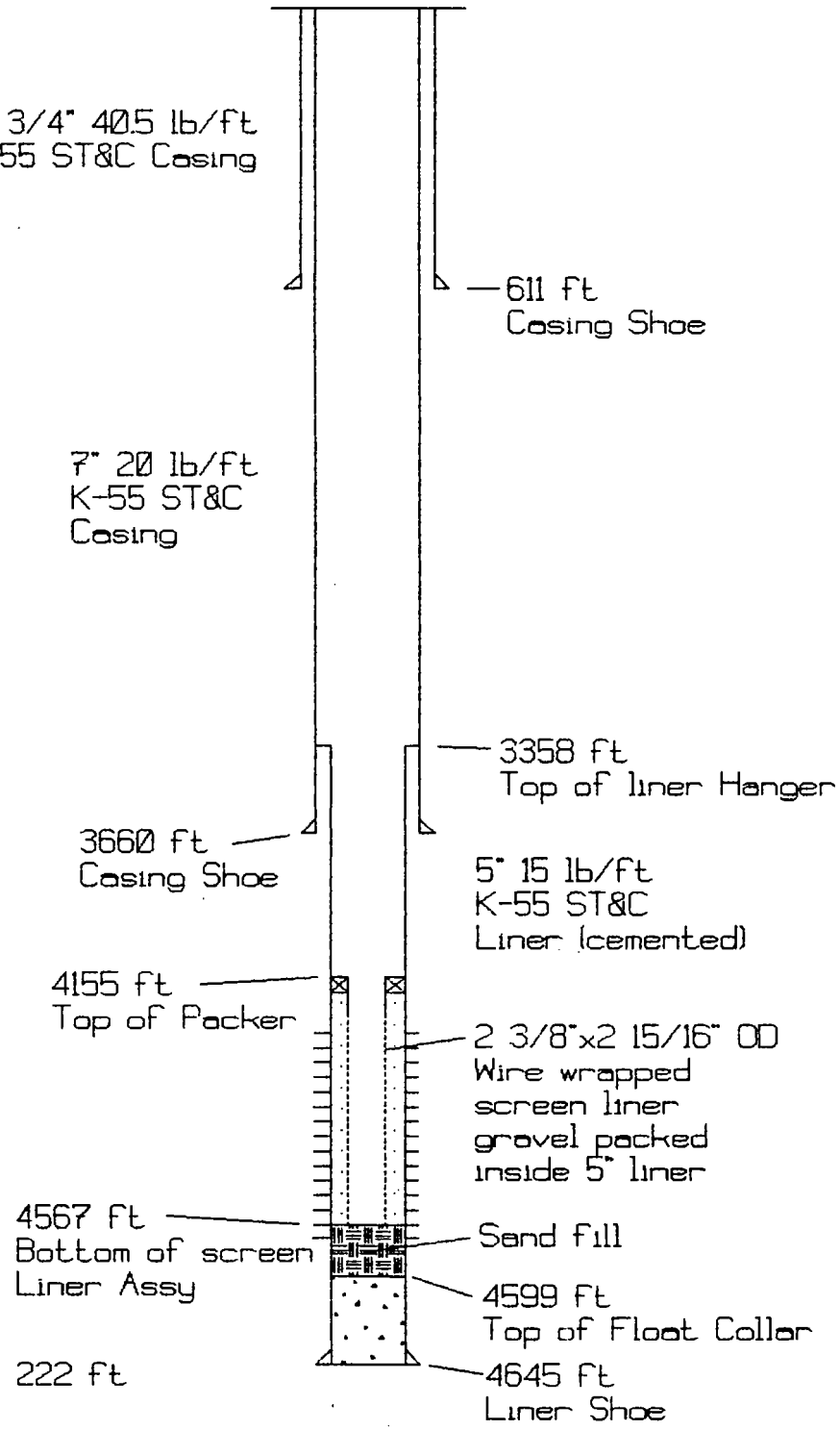
Samples of sand from the cleanout operation were given to Otis Engineering and Baker Hughes Inteq (formerly Baker Sand Control) for size distribution analysis and sand control design recommendations. Both companies produced similar recommendations for a gravel-packed wire-wrapped screen liner inside the 5-in. cemented liner. Otis also proposed, as an alternative, an insitu consolidated gravel pack with no screen. The gravel-packed screen completion was selected, and Baker was chosen to supply the liner equipment and gravel packing services. The design called for a 0.020 gauge wire-wrapped screen and a 12-20 U.S. mesh gravel pack. Figure 7.1 is a diagram of the well, as completed, with the liner and gravel pack. The sand size distribution analysis and details of the wire-wrapped screen liner assembly are in Appendix C.

7.2 Field Operations

Beginning on June 2, rig operations were resumed to clean out sand and install the liner assembly and gravel pack. Sand was cleaned out of the hole by conventional circulation with

Figure 7.1

Casing Diagram
NCPA Lodi STIG #1 Injection Well
June 6, 1993 After Installation of Gravel Packed Liner



Perforations:

4 jet shots/ft, 0.31-in. holes,

120° phasing

4.234 - 4.239
4.244 - 4.254
4.267 - 4.288
4.296 - 4.306
4.312 - 4.326
4.331 - 4.379
4.390 - 4.411
4.432 - 4.507
4.528 - 4.538
4.565 - 4.573

Total net perforated interval = 222 ft

* Depths are based on HLS open hole logs dated 5/2/93 and 5/7/93

water containing three percent potassium chloride. The return water was filtered through five-micron cartridge filters before being recirculated. At depths below 4,220 ft, HEC polymer was added to build viscosity and maintain circulation. Sand was cleaned out to the top of the float collar at 4,599 ft and a high-viscosity pill of water with HEC polymer was spotted to stabilize the sand. On June 5, before running the wire-wrapped screen liner, it was found that 107 ft of sand had collected in the wellbore. The sand was circulated out, and another high-viscosity polymer pill containing an enzyme breaker was spotted in the 5-in. liner.

The wire-wrapped screen liner assembly was then made up and run in the well. It stopped 32 ft high, indicating that some sand fill had again accumulated in the well. The liner was set at this point, placing the bottom of the screen section at 4,567 ft and the top of the liner hanger/packer at 4,155 ft. The bottom six feet of perforations in the 5-in. liner were left covered with sand. This minor loss of injection interval did not justify pulling the wire-wrapped screen liner assembly and cleaning out sand fill again.

The annular space between the 5-in. liner and the wire-wrapped screen liner was then gravel-packed with 12-20 mesh sand using a clear HEC polymer fluid with enzyme breaker to place the sand. The placement was done under pressure to force the 12-20 mesh sand out through the perforations. Initially, the liner was packed with 28 cu ft of sand, which constituted an excess of 26 percent over the annular volume inside the 5-in. liner. The well was then allowed to stand over night to give the gravel pack a chance to settle, and an additional four cubic feet of 12-20 mesh sand was pumped in. This completed the gravel packing job, and the well was ready for injection testing.

8.0 TEMPERATURE LOG AND INJECTION TEST

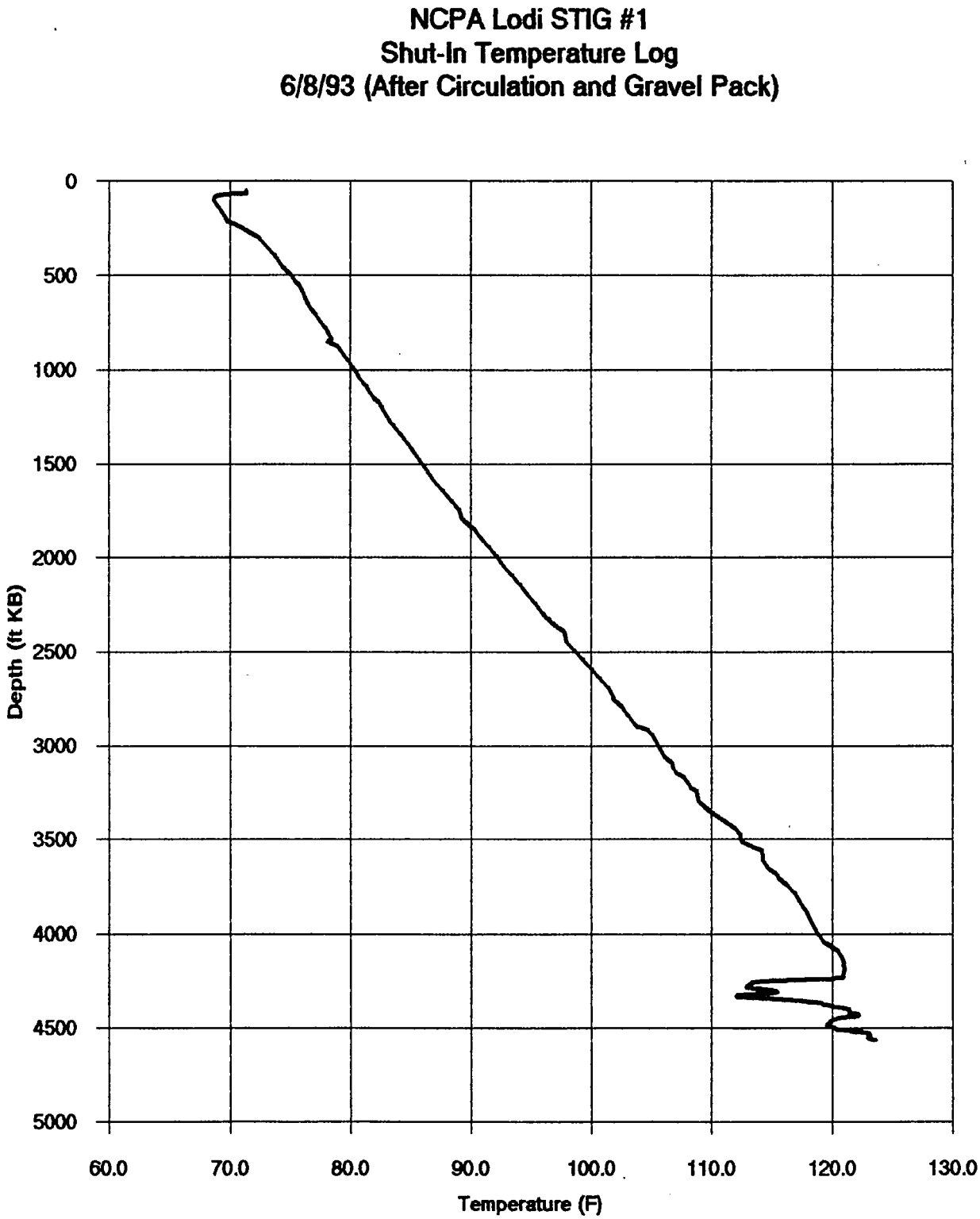
8.1 Pre-Injection Temperature Log

On June 8, 1993, prior to starting the injection test, a shut-in temperature log was run from 50 ft to the bottom of the screen liner at 4,567 ft. The log was run 48 hours after completion of gravel packing. It indicated the standing water level to be 51 ft below ground level, and the temperature on bottom was 123.7°F. A copy of the log is included in Appendix A, and a compressed plot of the temperature profile is shown in Figure 8.1. The temperature profile is normal except for a distinct residual cooling anomaly below 4,234 ft caused by fluid loss to the formation. The log shows clearly that the water lost during circulation and gravel packing was confined vertically to the perforated interval. There is no indication of interzonal flow.

8.2 Injection Test and Logging Operations

Following the temperature log, a step-rate injection test was done in conjunction with cased-hole logging to quantify injectivity, determine the formation transmissivity, define the injection profile and verify that there is no movement of injected water upward past the confining layer. As described in Section 4.0, water from the cleanout and production operation had been filtered and stored in three 500-barrel tanks on location. For the injection test, water was drawn from the three tanks, refiltered through five-micron cartridge filters and injected in the well using a Halliburton pump truck. The injection flow rate at each step was set and maintained by the Halliburton pump rpm. The rates and cumulative injection volumes were verified by periodic gaugings of the tanks.

Figure 8.1


NCPA Lodi STIG #1
Shut-In Temperature Log
6/8/93 (After Circulation and Gravel Pack)
Depth (ft KB)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
Temperature (F)

The test was planned as a three-rate test, but delays due to logging tool problems caused the duration of the first rate step to be extended, leaving only enough water for one other rate step. The test objectives were achieved, however, with the two-rate test.

Injection began at 1023 hrs, and the rate was increased gradually over a period of 22 minutes to 210 gpm. Except for a brief period when the rate was diminished by plugged filters, the 210 gpm rate was maintained for three hours and 21 minutes, during which the following logging operations were performed:

1. The logging tool, previously parked at 4,000 ft, recorded pressure from 1017 hrs until 1112 hrs.

2. Spinner log No. 1 was run from 4,565 ft to 3,000 ft at 100 fpm.

3. Spinner log No. 2 was run as a repeat of No. 1.

4. A temperature log was run from 4,000 ft to 4,567 ft at 80 fpm.

5. A R/A tracer slug was released at 3,320 ft and a gamma ray log was run to check integrity of liner lap and 7-in. casing shoe. No leakage was indicated.

6. Beginning at 1402 hrs, the logging tool was parked at 4,000 ft again, and pressure was recorded for the last four minutes of injection at 210 gpm.

At 1406 hrs, the injection rate was reduced to 126 gpm. Except for the final 1.6 minutes, this rate was maintained until the test was terminated at 1512 hrs. The injection rate

during the final 1.6 minutes dropped off because the Halliburton pump cavitated due to low water levels in the tanks. During injection at 126 gpm, the following logs were run:

1. Pressure at 4,000 ft was recorded during the rate change and for the first 16 minutes at the 126 gpm rate.

2. Spinner log No. 3 was run from 4,000 ft to 4,565 ft at 100 fpm.

3. Spinner log No. 4 was run from 4,565 ft to 4,000 ft at 100 fpm.

4. Spinner log No. 5 was run from 4,000 ft to 4,565 ft at 150 fpm.

5. Spinner log No. 6 was run from 4,565 ft to 4,000 ft at 150 fpm.

6. Beginning 20 minutes before the end of the test, the logging tool was parked at 4,000 ft to record the final injection pressure and pressure falloff. The falloff was recorded for 45 minutes.

7. A noise log was run in the interval from 1,200 ft to 500 ft to check for evidence of flow behind casing.

8.3 Logging Results

Copies of the spinner, tracer, temperature and noise logs are included in Appendix A. Only one spinner logging run for each injection rate is shown on the June 8 log. Spinner log Nos. 1 and 6 were chosen as most representative and are the ones presented. In each spinner profile, there are unusual perturbations caused by changes in the cross sectional area of flow at

connections and blanks in the wire-wrapped screen liner. For each of the two profiles presented, Flo-Log has shown zone-by-zone and cumulative representations of the injection rate profiles on the log. Conclusions from the logging results are summarized as follows:

1. The pre-injection shut-in temperature log indicates a distinct residual cooling anomaly within the perforated interval due to cooling by fluid lost to the formation during circulation and gravel packing. The profile shows clearly that the fluids were confined vertically below the top perforation at 4,234 ft.

2. The injection profile at each rate, as interpreted by Flo-Log, is shown on the log. The profiles show that essentially all the perforated intervals down to about 4,500 ft are taking water. The sand at 4,312 ft - 4,326 ft takes a disproportionately high percentage of the water and, therefore, must have a higher permeability than the others.

3. The R/A tracer check at the 5-in. liner top indicated no leakage.

4. The temperature profile which was logged 45 minutes after the start of injection (referred to as the "dynamic temperature" on the log) exhibits a rapid increase in temperature below 4,500 ft, confirming indications of the spinner logs that very little water is exiting through the lower two sets of perforations in the 5-in. liner.

   The temperature at 4,000 ft is 76°F on this log, but two later readings taken from the digital readout in the logging truck were 70°F and 72.3°F. On this basis, an "average" injection water temperature of 72°F was chosen as representative for determining fluid properties used in the pressure transient analysis.

5. The spectral noise log in the interval 1,200 ft - 500 ft gives no indication of fluid flow behind casing.

Rate and pressure data for the test are given in Figure 8.2 and Table D-1. Although not as evident in the figure, the data in Table D-1 indicate that there were pressure spikes associated with the rate changes. These are believed to be a result of surges associated with adjustments of the pump truck throttle. They are momentary, however, and are negligible with respect to the pressure transient analysis. In Table D-1, the right-hand column is titled "Calculated Pressure at Sandface at 4,400 ft". Values in this column were calculated from the measured pressure at 4,000 ft, which are also listed in the table. The calculation allowed for the additional 400 ft of water head and flowing pressure losses in the 5-in. liner, wire-wrapped screen liner and gravel-packed perforations.

8.4 Injection Test Analysis

The data from the injection test were analyzed by two methods. The first method was a semi-log straight line analysis using a Horner plot to estimate the well's skin factor and the formation transmissivity (kh). As a confirmation of the semi-log result, a steady-state analysis was done using the well's measured injectivity index and Darcy's law to estimate the formation kh. The two methods yield reasonably consistent results.

Shown in Figure 8.3 is a plot of sandface pressure versus Horner time. A reasonable straight line section is found between Horner times of about 60 and 46. The straight line has a slope of 55 psi/log cycle. Also needed for permeability and skin calculations is the bottomhole pressure at one hour shut-in time. This was found to be 1833 psia. These values along with known or estimated formation and fluid properties were used to calculate kh, permeability and

FIGURE 8-2
NCPA Lodi STIG #1
Injection Test – Injection Rate and Measured Pressure @ 4000 feet
June 8, 1993

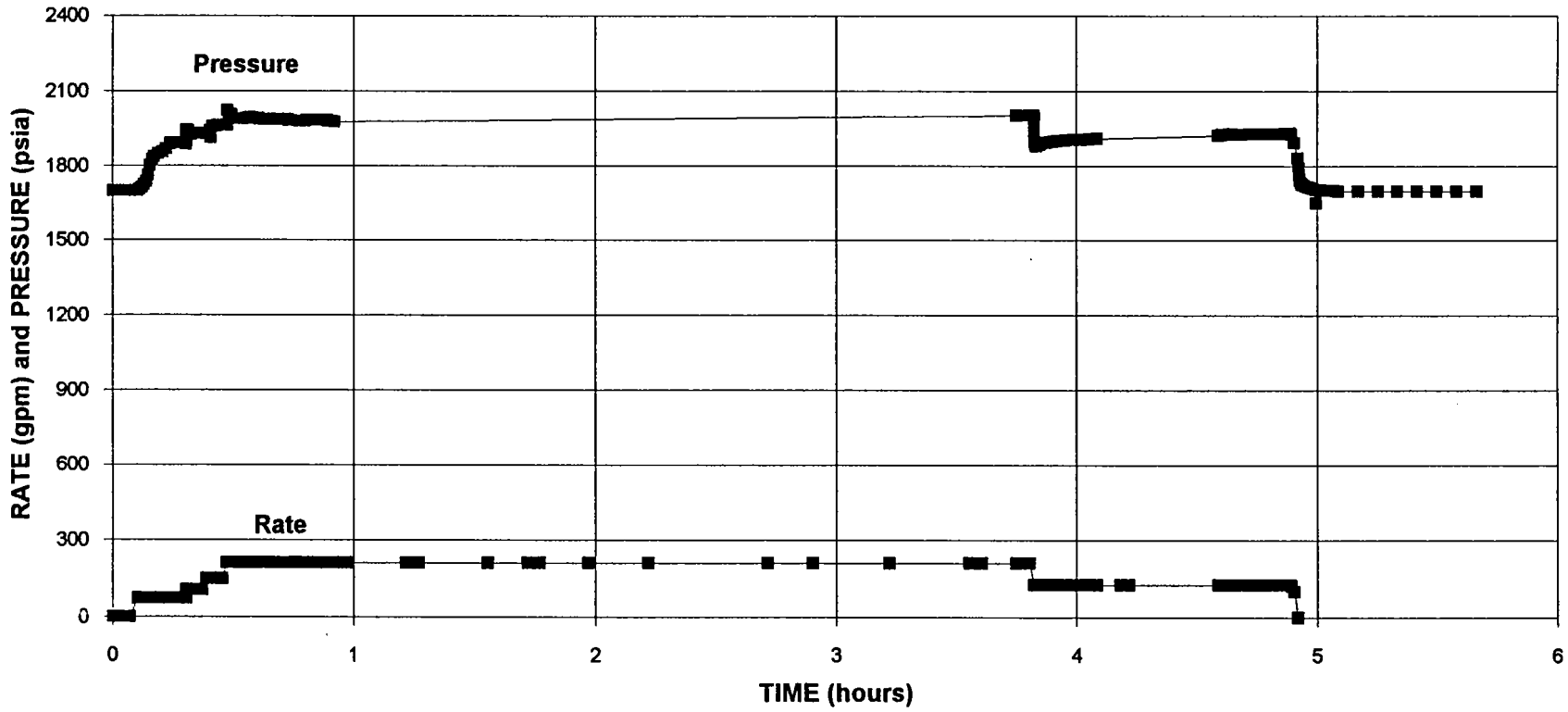
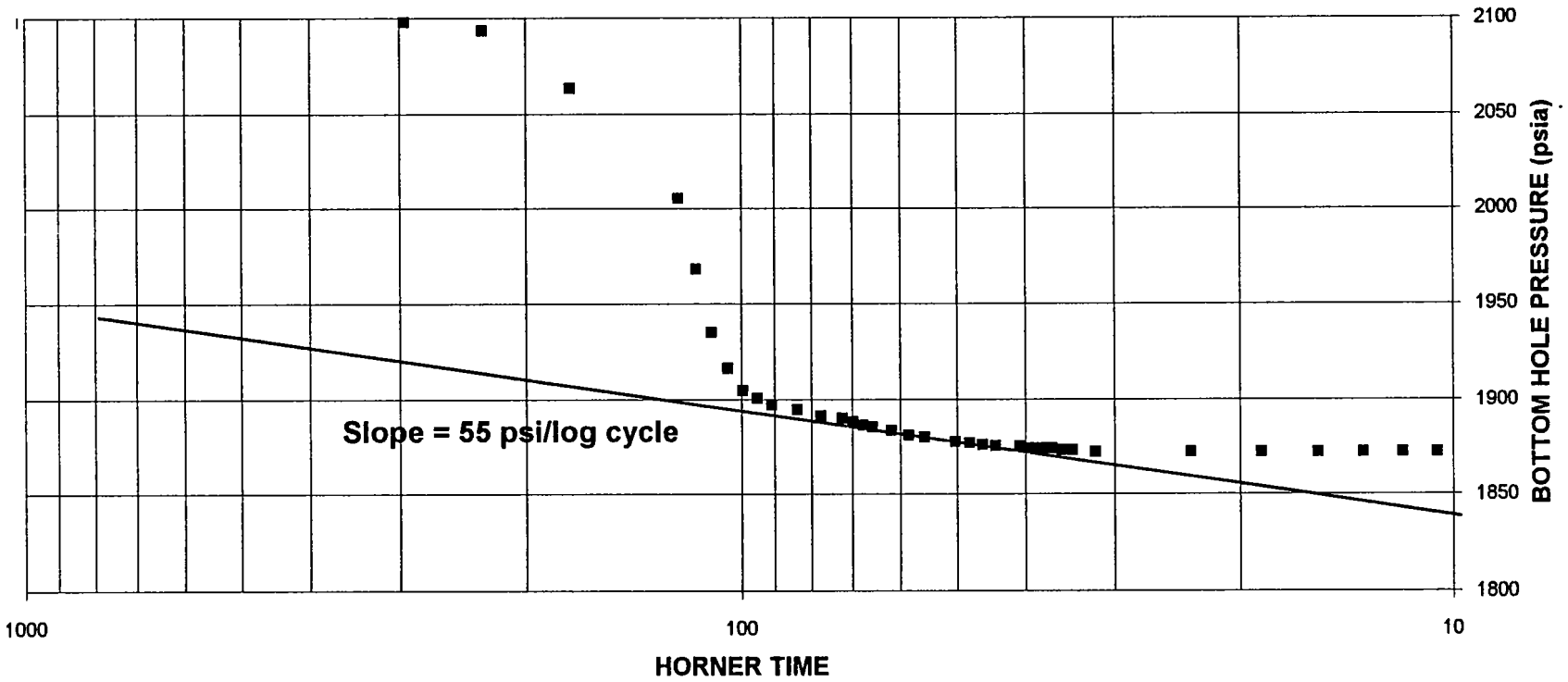


FIGURE 8-3
NCPA Lodi STIG#1
Horner Plot for Injection Test



skin. An outline of the calculations is in Appendix D. A kh of 12,500 md-ft and a permeability of 54.4 md were calculated. For skin factor, a value of 0.11 was calculated. The effective length of the completion interval (h) used in the calculations is 230 ft. This was derived on the following premises:

1. The June 8 shut-in temperature profile indicates that "injected" fluid was confined vertically below the top perforation at 4,234 ft. Therefore, sands above this depth are not effectively in the injection interval, at least within the radius affected by this test.

2. Although the 21-ft interval, 4,411-4,432 ft was not perforated, the rest of the 117-ft sand body from 4,390 to 4,507 ft was perforated. Therefore, it is assumed that the entire 117 ft is part of the effective completion interval.

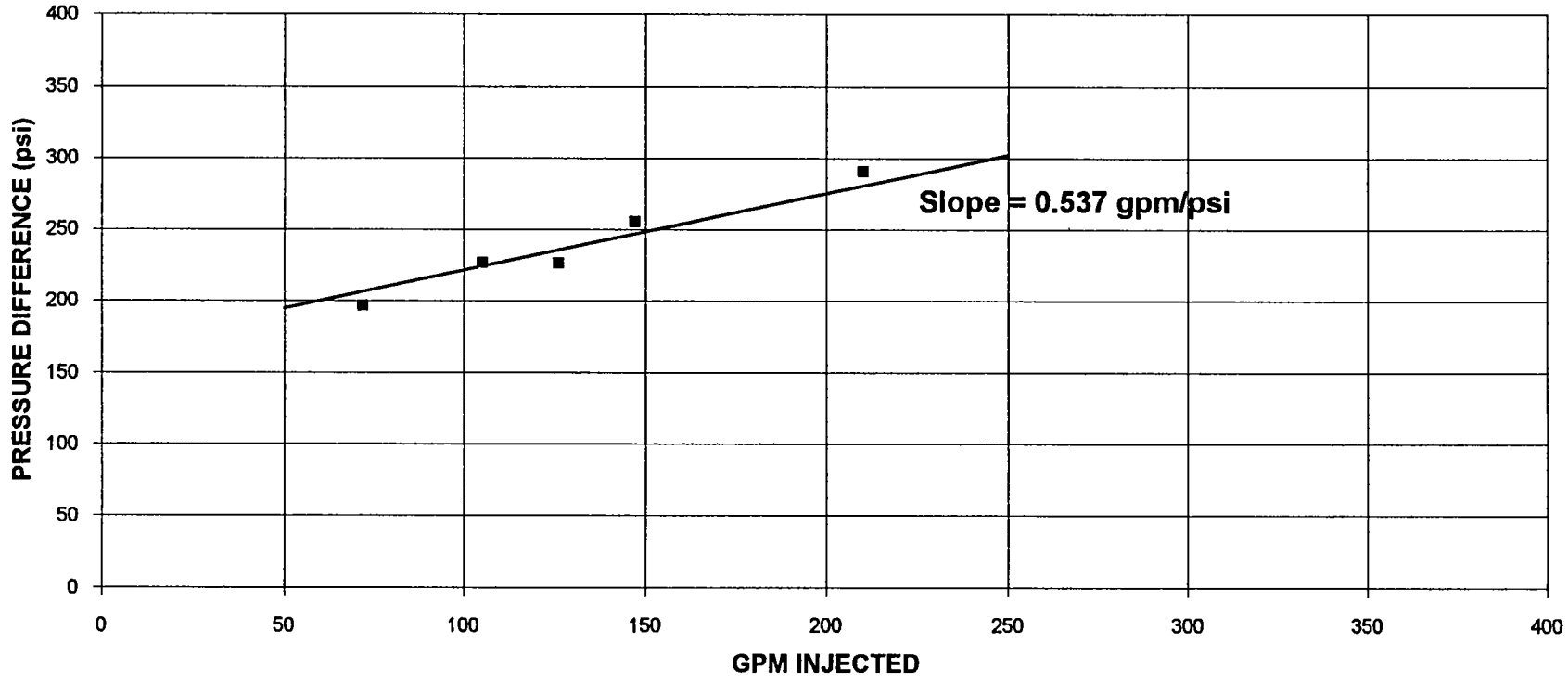
3. The bottom perforated interval, 4,567- 4,573 ft is blocked off by sand fill.

4. The interval 4,528-4,538 ft is open to injection, but the spinner and temperature logs indicate it is taking little if any water.

5. By eliminating the bottom two sands (below 4,528 ft), the net sand interval open to injection is estimated to be 230 ft.

Shown in Figure 8.4 is a plot of sandface pressure difference (psi) versus stabilized injection rate (gpm). The slope of a straight line drawn through these points is the Injectivity Index (II). The II was found to be 0.537 gpm/psi. If it is assumed that each point in the injectivity plot represents steady-state conditions, then the radial form of Darcy's law can be used to estimate the formation permeability. Needed in this type of analysis is an estimate of

FIGURE 8-4
NCPA Lodi STIG#1
Pressure Difference versus Injection Rate



the radius of investigation, r_{inv}. An expression for r_{inv} was found in the literature and used in the calculations, which are outlined in Appendix D. From this analysis, permeability was estimated to be 72.6 md, which is a reasonable confirmation of the semi-log analysis.

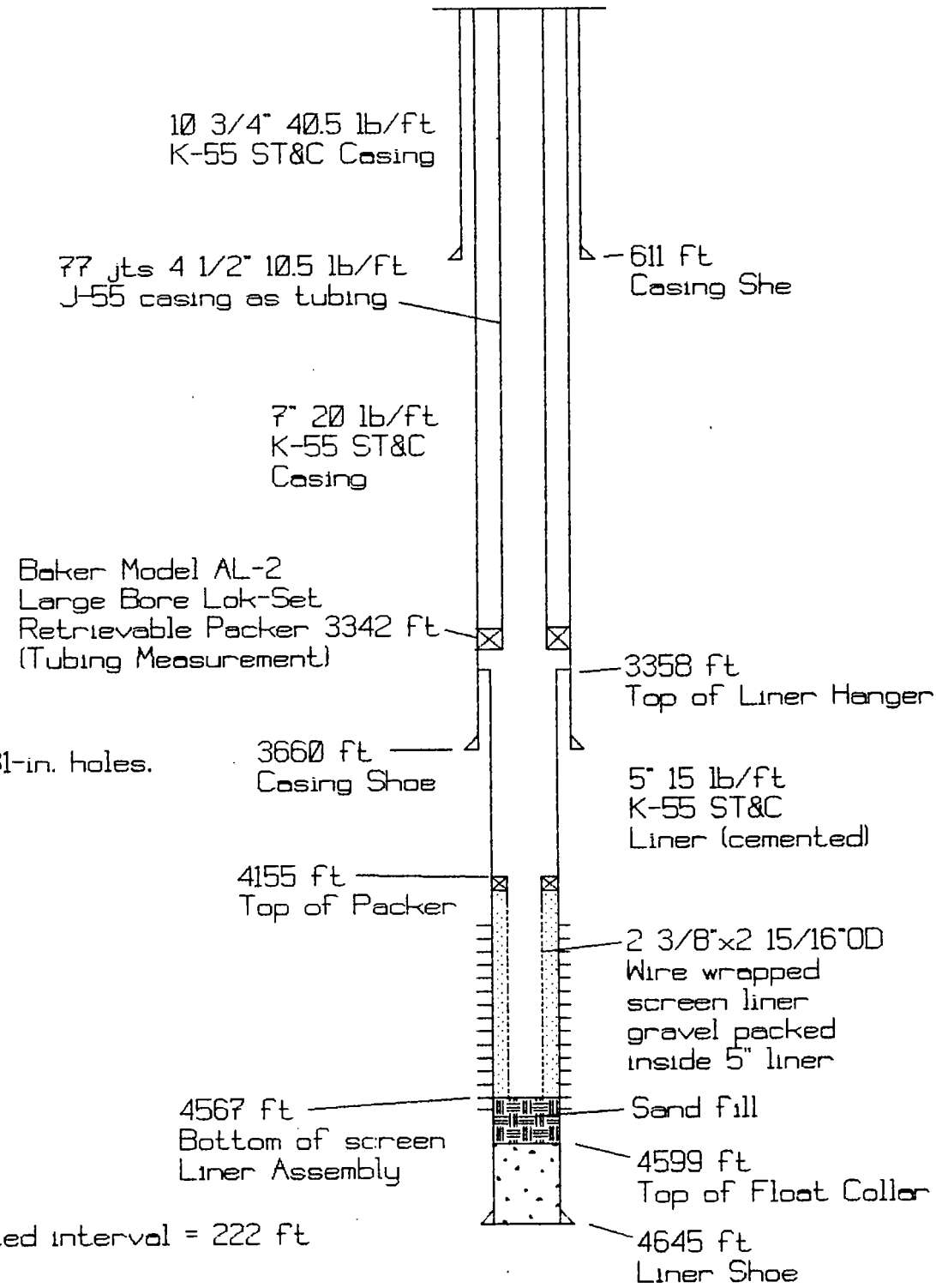
9.0 INSTALLATION OF TUBING AND PACKER

On June 9, 1993, injection tubing and a packer were installed in the well. The packer was set in the 7-in. casing at a depth of 3,342 ft KB and the tubing/casing annulus was pressure tested to 500 psi for 30 minutes. The pressure was bled off and the well was left shut-in, ready for injection service. Figure 9.1 is a diagram of the well, as completed. The tubing is 4½-in. O.D., 10.5 lb/ft API K-55 LT&C R3, and the packer is a Baker Model AL-2 large-bore Lok-Set.

Future injection capacity of the well as a function of wellhead pressure was estimated on the basis of the June 8 injection test data with calculated corrections for water density and pressure loss in the 4½-in. tubing. In Figure 9.2, wellhead pressure is plotted for the three injection rates at which the most stable pressures were obtained during the June 8 injection test. A straight line fit of these points is also shown in the figure. The injection test was performed with 15,000 ppm TDS water from the storage tanks on site, and there was no tubing in the well at the time. To estimate injection wellhead pressure as a function of injection rate during future operation of the well, a curve was constructed by adding the following factors to the straight line approximation of the injection test data:

Figure 9.1

Well Diagram
NCPA Lodi STIG #1 Injection Well
June 9, 1993, Final Completion



Perforations:

4 jet shots/ft. 0.31-in. holes.

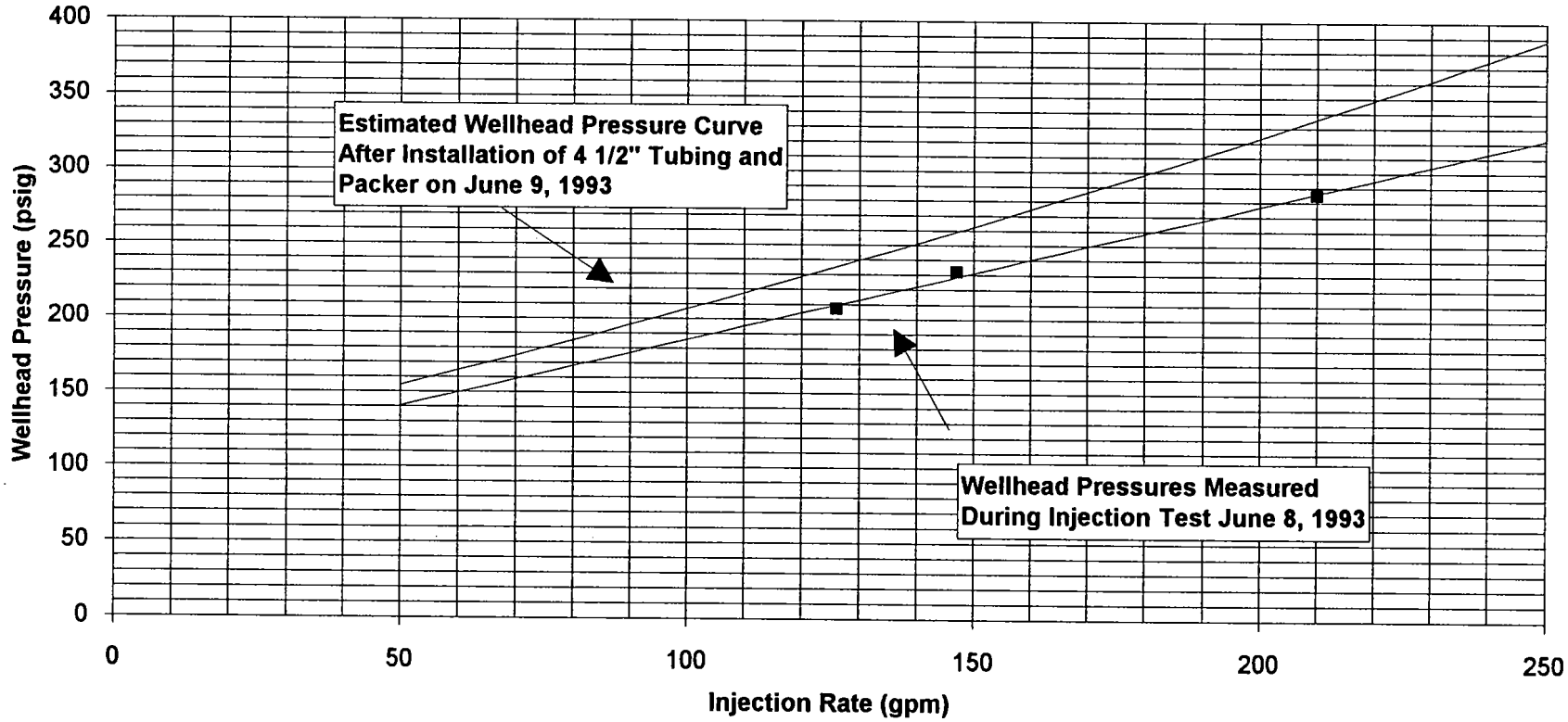
120° phasing

4,234 - 4,239
4,244 - 4,254
4,267 - 4,288
4,296 - 4,306
4,312 - 4,326
4,331 - 4,379
4,390 - 4,411
4,432 - 4,507
4,528 - 4,538
4,565 - 4,573

Total net perforated interval = 222 ft

* Depths are based on HLS open hole logs dated 5/2/93 and 5/7/93, except as noted.

Figure 9.2
NCPA Lodi STIG #1
Injection Pressure versus Rate



- Calculated friction loss in the 4½-in. tubing, as a function of injection rate, was added. (Friction loss in the 7-in. casing during the injection test was negligible, so no adjustment was made for it.)

- A correction of 11.9 psi was added to account for the difference in gravity head resulting from the density difference between the 15,000 ppm TDS water injected during the test and the nominal 2,000 ppm TDS water expected during commercial operation.

The resulting curve is plotted in Figure 9.2, and indicates an expected wellhead pressure of about 265 psig at the nominal design injection rate of 150 gpm.

10.0 CONFINING LAYER LEAKOFF TEST

On May 10, 1993, after cementing 7-in. casing in the Nortonville shale (the confining layer) and drilling out two feet below the casing shoe, a water shutoff (WSO) test was performed to confirm cement integrity at the casing shoe. Following the WSO test, a formation leakoff test was done with the intent of establishing a limiting pressure for injection to avoid formation breakdown in the confining layer. Both tests were done using conventional drillstem test (DST) tools. Downhole pressure data from a DST recorder are used in the following analyses and are included in Halliburton's report in Appendix E.

The WSO test results were completely normal and demonstrated satisfactory isolation at the 7-in. casing shoe. The test is reported in Halliburton's report in Appendix E.

After the WSO test, the DST packer was unset, and a leakoff test was performed by pumping through the tubing head valves. The pressure was increased in increments of

100 psi using the rig pump. Pressure was observed on a gauge at the surface and recorded by the DST instruments. The leakoff test data from Halliburton's report are summarized in Table 10.1. For redundancy, two DST instruments were used, but the results are comparable, and the data from Gauge No. 1263 were used for this analysis.

As shown in the table, pressure was increased in six increments to a maximum "true initial pressure" of 2,297.5 psig at 3,534 ft KB, the depth of the pressure recorder. The observed pressure at the surface on the final increment was approximately 550 psig, and the mud density in the hole was 9.6 lb/gal. With each step increase of pressure, the recorder charts show a pressure spike and an instantaneous falloff to the "true initial pressure" for each stage. The pressure spike is characteristic of the surge and momentary back-flow of a mud pump. It would not normally be noticed on a conventional pressure gauge but is apparent on the recorder charts. The "true initial pressure" in Table 10.1 corresponds to the surface pressure gauge reading (except for mud column head) that would be observed on a conventional leakoff test with no downhole recorders.

On Stages 2-6 of the test, there is a relatively long observation period between pressure increments, during which there is a gradual pressure decline in the range of 5.5 to 16.6 psi/min. This decline is apparently due to a minor leak in the mechanical system, rather than a formation breakdown, because the rate of pressure decline remained relatively low and generally decreased throughout the test. There were no indications of a formation breakdown, which would have been characterized by a rapidly accelerating rate of leakoff. The test was terminated before breakdown pressure was reached, so the results did not define an upper limit on injection wellhead pressure.

Table 10.1

SUMMARY OF CONFINING LAYER LEAKOFF TEST DATA[1]

NCPA Lodi STIG No. 1

May 10, 1993

Stage No.	Initial Pressure Spike[2] *(psig)*	True Initial Pressure[3] *(psig)*	Final Pressure[4] *(psig)*	Pressure Loss[5] *(psi)*	Observation Period *(min)*	Average Leakoff Rate[5] *(psi/min)*
1	1956.6	N/A	1943.9	12.7	0.8	15.9
2	2089.2	2084.7	2021.7	63.0	3.8	16.6
3	2194.9	2185.0	2116.8	68.2	6.9	9.9
4	2226.2	2203.0	2165.6	37.4	4.7	8.0
5	2283.5	2264.4	2226.4	38.0	3.7	10.3
6	2324.5	2297.5	2221.0	76.5	13.9	5.5

[1]Data from Halliburton Gauge No. 1263, Table E-1

[2]Pressure reading identified by [1] in Table E-1

[3]Pressure reading identified by [3] in Table E-1

[4]Pressure reading identified by [2] in Table E-1

[5]Based on "true initial pressure", except for first stage.

The water injection wellhead pressure equivalent to the highest pressure reached during the test is calculated by first determining the pressure at the casing shoe at the final pressure step, and then calculating the corresponding wellhead pressure with water in the well. For internal consistency of these calculations, depths of the 7-in. casing shoe (3,674 ft KB) and the DST pressure recorders (3,534 ft KB) are based on casing tally and drillpipe measurements, respectively. Although this casing shoe depth differs from the HLS log-based depth used elsewhere in this report, the difference is negligible for purposes of these calculations.

Pressure at the 7-in. casing shoe at the last pressure increment is calculated as follows:

Recorded pressure at 3,534 ft KB =	2,297.5 psig
Mud column pressure between DST pressure recorder and 7-in. casing shoe =	
(3,674 - 3,534) ft * 0.499 psi/ft =	69.9 psi
Pressure at 7-in. casing shoe =	2,367.4 psig

Wellhead pressure (at ground level) with water in the well and negligible friction pressure loss is calculated as follows:

2,367.4 psig - 0.434 psi/ft * 3,660 ft = 779 psig,

where the pressure gradient of 0.434 psi/ft is for nominal conditions of 70°F water with 2,000 ppm TDS.

The pressure gradient (from ground level) represented by

$$2{,}367.4 \text{ psig at the casing shoe} = 2{,}367.4 \text{ psi}/3{,}660 \text{ ft} = 0.65 \text{ psi/ft.}$$

Based on other leakoff test data in the Nortonville, the maximum test gradient of 0.65 psi/ft fell short of formation breakdown, and a wellhead pressure limitation higher than 779 psig is justifiable. The Victor Fine Foods wastewater disposal well at Lodi (VFF Deep Injection Well No. 1) was tested to incipient breakdown at a 0.73 psi/ft gradient in the Nortonville. Applying this value as a reasonable estimate of the incipient breakdown gradient at the NCPA Lodi STIG #1 site, the corresponding water injection wellhead pressure would be calculated as follows:

$$(0.730 - 0.434)\text{psi/ft} * 3{,}660 \text{ ft} = 1{,}083 \text{ psig}$$

To arrive at a reasonably conservative injection pressure limitation for the NCPA well, this calculated pressure is reduced by 10 percent.

$$\text{Recommended injection pressure limitation} = 0.9 * 1{,}083 \text{ psig} = 975 \text{ psig}$$

This pressure is equivalent to a gradient of 0.70 psi/ft at the shoe of the 7-in. casing.

In reality, a limitation of 975 psig is slightly more conservative than indicated by the above calculations. This is because NCPA Lodi STIG #1 has a cemented liner, and pressure in the Domengine will be confined at the base of the Nortonville (3,747 ft KB) which is 87 ft deeper than the shoe of the 7-in. casing.

The recommended wellhead pressure limitation of 975 psig represents a moderate pressure gradient at the shoe of the 7-in. casing, and the deeper isolation at the base of the Nortonville provides an additional margin of protection.

Appendix A

CASED HOLE LOGS

Table A-1

NCPA Lodi STIG #1
Shut-In Temperature Log

5/12/93 (Before Perforating)
(Depths are based on HLS open hole log dated 5/7/93)

Depth (ft KB)	*Temp. (Deg. F)*	*Depth (ft KB)*	*Temp. (Deg. F)*	*Depth (ft KB)*	*Temp. (Deg. F)*	*Depth (ft KB)*	*Temp. (Deg. F)*	*Depth (ft KB)*	*Temp. (Deg. F)*
100	81.1	879	82.8	2150	98.2	3450	115.4	4315	124.3
200	81.0	900	82.8	2200	98.7	3484	115.5	4323	124.3
215	81.0	911	82.8	2250	99.1	3500	115.5	4325	124.3
250	80.9	927	83.3	2300	99.8	3525	115.8	4338	124.4
300	80.8	955	83.4	2350	100.5	3550	116.1	4340	124.3
400	80.7	975	83.7	2400	101.1	3568	116.3	4345	123.9
460	80.7	990	83.9	2450	101.7	3600	116.7	4350	124.8
465	80.0	1010	84.0	2500	102.5	3620	117.0	4370	125.1
470	79.6	1050	84.2	2550	103.1	3650	117.4	4380	125.3
480	79.5	1090	85.0	2600	103.8	3660	117.7	4385	125.4
490	79.6	1109	85.0	2650	104.4	3670	118.5	4400	125.6
500	79.7	1150	85.6	2700	105.0	3680	119.2	4412	125.8
530	80.0	1175	86.1	2750	105.5	3691	119.2	4425	126.1
550	80.2	1200	86.4	2758	105.6	3700	118.9	4431	126.1
580	80.9	1212	86.6	2800	105.9	3710	118.8	4440	126.2
585	81.0	1240	86.6	2850	106.4	3730	118.8	4447	126.2
598	81.0	1280	86.8	2900	106.9	3755	119.0	4450	126.2
600	80.8	1300	87.0	2908	107.0	3792	119.1	4462	126.2
610	80.8	1325	87.3	2926	107.2	3800	119.3	4480	126.6
618	80.5	1350	87.6	2950	107.5	3850	119.6	4491	126.8
625	80.5	1400	88.2	3000	108.2	3900	120.1	4500	126.8
628	80.4	1450	88.8	3050	108.8	3950	120.6	4510	126.8
648	80.4	1500	89.5	3065	109.0	4000	121.3	4520	126.8
655	80.5	1550	90.4	3100	109.4	4050	121.8	4530	126.8
690	80.8	1600	91.1	3130	109.8	4100	122.7	4535	126.7
692	80.9	1650	91.8	3150	110.1	4130	123.0	4541	126.7
700	81.0	1700	92.7	3175	110.5	4150	123.4	4547	126.7
710	81.2	1750	93.2	3200	110.8	4165	123.6	4550	126.8
735	81.2	1800	93.8	3230	111.3	4200	123.6	4560	126.8
750	81.5	1850	94.4	3250	111.7	4244	123.6	4564	126.8
783	81.9	1900	95.0	3300	112.5	4250	123.6	4570	126.7
800	81.9	1950	95.7	3305	113.0	4266	123.9	4580	126.7
815	81.9	2000	96.3	3310	113.2	4270	124.0	4590	127.0
835	82.4	2050	96.8	3350	114.2	4296	124.2	4600	127.1
855	82.4	2100	97.4	3400	115.1	4300	124.2		

Table A-2

NCPA Lodi STIG #1
Shut-In Temperature Log

6/8/93 (After Circulation and Gravel Pack)
(Depths are based on HLS open hole log dated 5/7/93)

Depth (ft KB)	Temp. (Deg. F)	Depth (ft KB)	Temp. (Deg. F)	Depth (ft KB)	Temp. (Deg. F)	Depth (ft KB)	Temp. (Deg. F)	Depth (ft KB)	Temp. (Deg. F)
50	71.4	813	78.3	2046	92.8	3393	110.9	4307	115.4
65	71.4	833	78.6	2096	93.5	3443	112.0	4314	115.4
75	69.5	853	78.2	2146	94.2	3477	112.5	4316	115.0
85	68.8	877	79.1	2196	94.8	3493	112.5	4329	112.3
100	68.7	898	79.3	2246	95.5	3518	112.6	4331	112.1
200	69.7	909	79.4	2295	96.0	3543	113.5	4336	112.1
215	69.8	925	79.5	2345	96.8	3561	114.2	4341	113.0
250	71.1	953	79.9	2395	97.8	3593	114.3	4361	117.9
299	72.4	973	80.1	2445	98.0	3613	114.3	4371	119.1
399	73.8	988	80.3	2495	98.7	3643	114.5	4376	119.3
459	74.5	1008	80.5	2545	99.4	3653	114.7	4391	120.1
464	74.6	1048	80.9	2595	100.1	3663	114.8	4403	121.5
469	74.6	1088	81.4	2645	100.8	3673	115.1	4416	121.5
479	74.8	1107	81.5	2695	101.5	3684	115.4	4422	121.5
489	75.0	1148	82.0	2745	101.9	3693	115.5	4431	122.2
499	75.1	1173	82.4	2753	101.9	3703	115.5	4438	122.3
529	75.5	1198	82.7	2794	102.6	3723	115.9	4441	121.9
549	75.8	1210	82.8	2844	103.2	3748	116.3	4453	120.4
579	76.1	1238	83.0	2894	103.8	3785	116.8	4471	119.8
584	76.1	1277	83.4	2902	103.9	3793	117.0	4482	119.6
597	76.2	1297	83.7	2920	104.8	3842	117.5	4491	119.6
599	76.2	1322	84.0	2944	105.2	3892	118.0	4501	120.3
609	76.3	1347	84.3	2994	105.6	3942	118.3	4511	120.4
617	76.3	1397	84.9	3044	106.0	3992	118.7	4521	121.8
624	76.3	1447	85.5	3059	106.2	4042	119.3	4526	122.5
627	76.4	1497	86.0	3094	106.8	4092	120.5	4532	123.1
647	76.5	1547	86.5	3124	106.9	4122	120.8	4538	123.2
654	76.6	1597	87.1	3144	107.2	4142	121.0	4541	123.2
689	77.0	1647	87.8	3169	107.8	4157	121.0	4551	123.0
691	77.0	1697	88.5	3194	108.1	4192	121.0	4555	123.0
699	77.0	1747	89.1	3224	108.4	4236	120.9	4561	123.3
709	77.2	1796	89.3	3244	108.8	4242	120.0	4567	123.7
734	77.5	1846	90.3	3294	109.0	4258	114.0		
749	77.6	1896	90.9	3298	109.0	4262	113.4		
781	78.1	1946	91.6	3303	109.1	4288	112.9		
798	78.2	1996	92.3	3343	109.8	4292	113.4		

Appendix B

LABORATORY REPORTS ON CHEMICAL ANALYSES

Advanced Technology Laboratories

RECEIVED JUN 1 8 1993

June 11, 1993

Mesquite
221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

ATTN: Mr. Skip Matlick

Project #: N/A
Sample Date: May 15 & 16, 1993
Lab No.: 930517-001/027

Gentlemen:

Enclosed are the results for sample(s) received by Advanced Technology Laboratories on May 17, 1993 and tested for the following parameter(s):

Nitrate	Total Metals	Cyanide
Sodium	Bicarbonate, Carbonate	Chloride
Sulfate	Oil and Grease	Phosphate
Specific Gravity	Conductivity	pH
Silicon	Total Suspended Solids	Total Dissolved Solids

The following test were subcontracted :

Asbestos – Particle Diagnostics (DOHS Cert. # 1291)
Coliforms – Silliker Laboratories (DOHS Cert. # 601)

The sample(s) arrived chilled, intact, with a chain of custody record attached.

Thank you for the opportunity to service the needs of your company. Please feel free to call me at (310) 989 – 4045 if I can be of further assistance to your company.

Sincerely,

Edgar P. Caballero
EPC/mp

Enclosures

This cover letter is an integral part of this analytical report.

Mailing Address: P.O. Box 9108 Newport Beach, CA 92658
1500 E. 33rd Street Signal Hill, CA 90807 Tel: 310 989-4045 Fax: 310 989-4040

Advanced Technology
Laboratories

June 4, 1993

Mesquite
221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

ATTN: Mr. Skip Matlick

Project #: N/A
Sample Date: May 15 & 16, 1993
Lab No.: 930517-001/027

Gentlemen:

Enclosed are the results for sample(s) received by Advanced Technology Laboratories on May 17, 1993 and tested for the following parameter(s):

Nitrate	Total Metals	Cyanide
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Sulfate	Oil and Grease	Phosphate
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Silicon	Total Suspended Solids	Total Dissolved Solids

The following test were subcontracted :

Asbestos – Particle Diagnostics (DOHS Cert. # 1291)
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The sample(s) arrived chilled, intact, with a chain of custody record attached.

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Sincerely,

Edgar P. Caballero
EPC/mp

Enclosures

This cover letter is an integral part of this analytical report.

Mailing Address: P.O. Box 9108 Newport Beach, CA 92658
1500 E. 33rd Street Signal Hill, CA 90807 Tel: 310 989-4045 Fax: 310 989-4040

4129 E. La Palma Avenue
Anaheim
California 92807

Tel 714.579-3800
Fax 714.579-3448

Q Laboratories, Inc.

June 7, 1993

Mr. Skip Matlick
Mesquite Group
221 N. Harbor Blvd. Ste K
Fullerton, CA 92623

Dear Skip:

In order to provide full laboratory services to our clients, Q Laboratories, inc. has joint venture with Advanced Technology, Inc.

Enclosed is the report of analysis of two water samples submitted on May 17 , 1993.

Thank you for the opportunity to provide laboratory services to your company. Please call if you have any questions concerning the results.

Sincerely,

Q LABORATORIES, INC.

Nellie M. Espiritu
Technical Director

Encl.

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Project: N/A
Matrix: Water

Lab No. : See Below
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93

EPA Method 120.1
(Conductivity)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-024	NCPA TDS 1	05/27/93	17,780.	micromhos/cm	–
930517-025	NCPA TDS I	05/27/93	26,600.	micromhos/cm	–

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Lab No.: 930517–012/013
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93
AMENDED

Project: N/A
Matrix: Water

Total Metals Results, in mg/l			
Sample ID:	NCPAC 1	NCPAC I	DLR
Aluminum	ND	ND	0.20
Arsenic *	ND	ND	0.005
Antimony	0.12	ND	0.10
Barium	1.59	1.38	0.01
Berrylium	ND	ND	0.01
Boron	9.0	6.9	0.01
Cadmium	ND	ND	0.01
Chromium	ND	ND	0.05
Copper	ND	ND	0.05
Iron	ND	ND	0.01
Lead	ND	ND	0.01
Manganese	0.26	0.21	0.01
Mercury **	ND	ND	0.005
Nickel	ND	ND	0.01
Selenium ***	ND	ND	0.005
Silver	ND	ND	0.01
Thallium	ND	ND	0.01
Zinc	ND	ND	0.01
Calcium	761.	705.	0.01
Magnesium	85.	75.	0.02
Potassium	46.	3625.	0.20
Sodium	3200.	3225.	1.0
Silicon	7.7	7.8	1.0

Approved By: _____ Date: 6/14/93

* = analyzed by Method 206.3
** = analyzed by Method 245.1
*** = analyzed by Method 270.3
**** = all others analyed by Method 200.7

Advanced Technology Laboratories

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Lab No. : See Below
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93

Project: N/A
Matrix: Water

EPA Method 365.3
(Phosphate)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-018	NCPAP 1	05/27/93	0.08	mg/l	0.01
930517-019	NCPAP I	05/27/93	0.28	mg/l	0.1

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite

Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

Attn: Mr. Skip Matlick

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

Project: N/A

Matrix: Water

EPA Method 150.1 (Ph)					
LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-024	NCPA TDS 1	05/21/93	7.85	–	–
930517-025	NCPA TDS I	05/21/93	8.15	–	–

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/8/93

Advanced Technology Laboratories

Client: Mesquite

Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

Attn: Mr. Skip Matlick

Project: N/A

Matrix: Water

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

EPA Method 160.1
(Total Dissolved Solids)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-024	NCPA TDS 1	05/21/93	14,066.	mg/l	5.
930517-025	NCPA TDS I	05/21/93	15,028.	mg/l	5.

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite

Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

Attn: Mr. Skip Matlick

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

Project: N/A

Matrix: Water

EPA Method 310.1
(Carbonate)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-014	NCPAA 1	05/27/93	ND	mg/l	1.0
930517-015	NCPAA I	05/27/93	ND	mg/l	1.0

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite

Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

Attn: Mr. Skip Matlick

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

Project: N/A

Matrix: Water

EPA Method 310.1
(Bicarbonate)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-016	NCPACA 1	05/20/93	62.	mg/l	1.0
930517-017	NCPACA I	05/20/93	99.	mg/l	1.0

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Lab No. : See Below
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93

Project: N/A
Matrix: Water

EPA Method 353.2
(Nitrate)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-014	NCPAA 1	05/27/93	14.	mg/l	5.0
930517-015	NCPAA I	05/27/93	5.1	mg/l	5.0

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite

Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

Attn: Mr. Skip Matlick

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

Project: N/A

Matrix: Water

EPA Method 375.4
(Sulfate)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-014	NCPAA 1	06/01/93	8.0	ug/ml	0.5
930517-015	NCPAA I	06/01/93	27.0	ug/ml	0.5

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Lab No. : See Below
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93

Project: N/A
Matrix: Water

EPA Method 413.2
(Oil & Grease)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-026	NCPA OG 1	05/27/93	ND	mg/l	2.5*
930517-027	NCPA OG I	05/28/93	ND	mg/l	2.5*

* = Insufficient sample for lower det'n limit.

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Lab No. : See Below
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93

Project: N/A
Matrix: Water

Specific Gravity

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-024	NCPA TDS 1	05/28/93	1.0004	@ 22C	–
930517-025	NCPA TDS I	05/28/93	1.0005	@ 22C	–

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite

Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623

Attn: Mr. Skip Matlick

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

Project: N/A

Matrix: Water

EPA Method 325.3 (Chloride)					
LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-014	NCPAA 1	05/27/93	7000.	mg/l	1.0
930517-015	NCPAA I	05/27/93	9600.	mg/l	1.0

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite

Address:

Attn: Mr. Skip Matlick

Project:

Matrix: Water

Lab No. : See Below

Date Rec'd: 05/17/93

Date Sampled: 05/15/93 & 05/16/93

EPA Method 335.2 (Cyanide)					
LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-022	NCPACY 1	05/19/93	ND	mg/l	0.1
930517-023	NCPACY I	05/25/93	ND	mg/l	0.1

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

Client: Mesquite
Address: 221 N. Harbor Blvd., Ste K
Fullerton, CA 92623
Attn: Mr. Skip Matlick

Lab No. : See Below
Date Rec'd: 05/17/93
Date Sampled: 05/15/93 & 05/16/93

Project: N/A
Matrix: Water

EPA Method 160.2
(Total Suspended Solids)

LAB NO.	SAMPLE ID	DATE ANALYZED	RESULTS	UNITS	DLR
930517-024	NCPA TDS 1	05/21/93	19.0	mg/l	5.
930517-025	NCPA TDS I	05/21/93	9.0	mg/l	5.

ND = Not Detected. Below indicated limit of detection.

Reviewed and Approved By: _____ Date: 6/4/93

Advanced Technology Laboratories

SILLIKER LABORATORIES
OF CALIFORNIA, INC.
1139 East Dominguez, Suite I
Carson, CA • 90746
(310) 637-7121 • FAX (310) 637-2953
MICROBIOLOGY • CHEMISTRY • CONSULTING • RESEARCH

LABORATORY REPORT

Report No.	Date	Page
177806	6/07/93	1

Purchase Order: 3153

SAMPLES RECEIVED: 5/18/93
RECEIVED FROM: PURI ROMUALDO

PURI ROMUALDO
ADVANCED TECHNOLOGY LABS
1500 E. 33RD STREET
SIGNAL HILL CA 90807

ANALYTICAL RESULTS

SAMPLE DESCRIPTION	COLIFORMS MPN/100ML
LOG#:930517-010 LOCATION:NCPACO 1 DATE:5/15 GRAB	<1.1 ABSENT
LOG#:930517-011 LOCATION:NCPACO I DATE:5/16 GRAB	>23.0 PRESENT

Standard Methods for the Examination of Water and Wastewater
18th Edition - 1992.

MCalicchia
MELISSA CALICCHIA, M.S.
DIRECTOR

PARTICLE DIAGNOSTICS, Inc. - 1274 Morena Blvd. - San Diego, CA - (619) 276-2200

ASBESTOS ANALYSIS
Transmission Electron Microscopy
Water Sample Analysis

Client : ADVANCED TECH. LABS.
Address : 1500 E. 33RD ST., SIGNAL HILL, CA, 90807

Client's Project # : PO# 3205
Client's Description : N/A
PDI Project # : 17562
Sample type : WATER
Sample Condition : intact/properly shipped
Comments :

Client Sample # : 930517-012 NCPAB1
PDI Lab I.D. # : 93-145081

Sample Volume (liters)	: .020000	Field counted	: 10
Final filter area (cm2)	: 2.08	Field area (um2)	: 11396
Original filter area (cm2)	: 2.08	Area ashed (cm2)	: 2.08
Magnification	: 16250	Dilution factor	: 1

Analytical sensitivity	(M struct./liter) :	0.
	(structures/mm2) :	8.
Limit of quantitation	(M struct./liter) :	0.
	(structures/mm2) :	35.

(Limit of quantitation based on counting a minimum of 4 structures)

DATA ANALYSIS DETAIL [calculated values]

Size	Category	Chrysotile	Amphibole	Ambiguous	Non-asbestos
<5.0μm	#counted	0	0	0	0
	MFL	0.0	0.0	0.0	0.0
	MBL	0.0	0.0	0.0	0.0
	MCL	0.0	0.0	0.0	0.0
	MML	0.0	0.0	0.0	0.0
≥5.0μm	#counted	0	0	0	0
	MFL	0.0	0.0	0.0	0.0
	MBL	0.0	0.0	0.0	0.0
	MCL	0.0	0.0	0.0	0.0
	MML	0.0	0.0	0.0	0.0

Asbestos structures <5.0μm in length (MSL) = < 0.
Asbestos structures ≥5.0μm in length (MSL) = < 0.

Total asbestos structures(MSL)= < 0.09
Total asbestos structures/mm2 = < 9

Total asbestos structures reported are based on 1 fiber (analytical sensitivity)

Analyst initials DL (DL) ____ Review date 6 / 10 / 93

Spike Recovery and RPD Summary Report

Method: 413.2
Analyst: CD
Data File: 128

Date: 05/28/93
Sample ID: 930528-000
Matrix: WATER

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Oil & Grease	mg/L	NA	0	0.00	8.00	6.60	6.60	83	83	80-120	0	20	2.5

Approved by: [signature] Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: Nitrate by IC
Analyst: CD
Data File: 147

Date: 05/27/93
Sample ID: 930517-015
Matrix: Water

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Nitrate	mg/L	NA	0	1.00	2.00	2.42	2.54	71	77	70-130	8	20	1.0

Approved by: _____ Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: 365.3 (o-Phosphate)
Analyst: CD
Data File: 147

Date: 05/27/93
Sample ID: 930527-000
Matrix: WATER

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
o-Phosphate	mg/L	NA	0	0.00	10.00	10.50	10.50	105	105	80-120	0	20	0.01

Approved by: _____ Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: 375.4
Analyst: DR
Data File: 152

Date: 06/01/93
Sample ID: 930517-015
Matrix: WATER

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Sulfate	mg/L	NA	0	27.00	40.00	64.00	66.00	93	98	80-120	5	20	0.5

Approved by: [signature] Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: 325.3
Analyst: CD
Data File: 147

Date: 05/27/93
Sample ID: 930517-014
Matrix: Water

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Chloride	mg/L	NA	0	7100.00	4440.00	11745.00	11567.00	105	101	80-100	4	20	1.0

Approved by: _____ Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: Selenium
Analyst: CD
Data File: 146-As.AAS

Date: 05/26/93
Sample ID: 930517-021
Matrix: Water

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Selenium	Ug/ml	NA	0	0.00	10.00	11.91	12.52	119	125	60-130	5	30	5.0

Approved by: [signature] Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: Arsenic
Analyst: CD
Data File: 146-As.AAS

Date: 05/26/93
Sample ID: 930526-000
Matrix: Water

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Arsenic	Ug/ml	NA	0	0.00	10.00	11.27	12.19	113	122	60-130	8	30	5.0

Approved by: [signature] Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: Mercury

Analyst: CD

Data File: 146A–Hg. AAS

Date: 05/26/93

Sample ID: 930517–013

Matrix: Water

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limit	RPD	RPD Limit	DLR
Mercury	Ug	NA	0	0.00	0.50	0.23	0.30	45 *	59 *	60–130		30	1.0

* Low recoveries due to matrix interference.

Approved by: _____ Date: 6/4/93

Spike Recovery and RPD Summary Report

Method: 335.2
Analyst: DR
Data File: 145

Date: 05/25/93
Sample ID: 930517-023
Matrix: WATER

ANALYTE	UNITS	LCS	METH BLANK	SPL CONC	SPK ADDED	MS RESULT	MSD RESULT	%MS REC	%MSD REC	% REC Limi	RPD	RPD Limit	DLR
Cyanide	Ug	NA	0	2.20	20.00	22.00	22.50	99	102	80-120	2	20	0.1

Approved by: [signature] Date: 6/4/93

Q Laboratories, Inc.

REQUEST FOR ANALYSIS/ CHAIN OF CUSTODY

Lab Job Number: X 305062
Lab Destination:
Date Samples Shipped:
Lab Contact:
Date Verbals Required:
Date Report Required:
Client Contact PH. No.:
Client Contact Fax No.:

Reporting Information:
1. Client: MESQUITE
Address:
Contact: SKIP MATLICK
Alt. Contact: DON CAMPBELL

Address Invoice To:
3.

Address Report To:
2.

Send Invoice To:
4.

Send Report To 1 or 2 (Circle one)
Client project/P.O. #: VERBAL
Sample Team Member ('s) SKIP MATLICK

ANALYSIS

Lab Number	Client Sample Identification	Air Volume	Date/ Time Collected	Sample Type *	Pres.	No. of Cont.	Type of Cont.	ASBESTOS	COLIFORM	METALS, SIO2	ANIONS	HCO3, CO3	PHOSPHATE	CA, Mg, K, NA					Comments/Inst., Hazards, etc.
01A	NCPAAS I		5/15/93					X											
02A	NCPAAS II		5/16/93					X	X										
03A	NCPACO I		5/15						X										
04A	NCPACO II		5/16						X	X									
05A	NCPAB I		5/15							X									
06A	NCPAB II		5/16							X	X								
07A	NCPAA I		5/15								X								
08A	NCPAA II		5/16								X								
09A	NCPACA I		5/15									X							
10A	NCPACA II		5/16									X							
11A	NCPAP I												X						
12A	NCPAP II												X						
13A	NCPAC I													X					
14A	NCPAC II													X					

		DATE	TIME			DATE	TIME
Relinquished by: (Signature)	Skip Matlick	5/17/93	0927	Received by: (Signature)	C MacLane	5-17-93	9:32
Relinquished by: (Signature)	C MacLane	5/17/93	3:49	Received by: (Signature)	Frank Lacco	5/17/93	3:49
Relinquished by: (Signature)		DATE	TIME	Received by: (Signature)		DATE	TIME
Method of Shipment				Lab Comments			

* Sample type (Specify): 1) 25 mm 0.45 Um MCEF 2) 25 mm 0.8 Um MCEF 3) 25 mm 0.4 Um polycarb. filter 4) 37 mm 0.8 Um 5) PVC filter diam. ____ pore size ____
6) Charcoal tube 7) Silica gel tube 8) Waste Water 9) Soil 10) Bulk 11) Other ____

COPIES: WHITE - JOB FILE • YELLOW - PROJECT FILE • PINK - CLIENT

4120 East La Palma Ave. Anaheim, CA 92807 • Tel. (714) 579-3300 Fax (714) 579-3448

Q Laboratories, Inc.

REQUEST FOR ANALYSIS/ CHAIN OF CUSTODY

Reporting Information:
1. Client: Mesquite
Address:
Contact: Skip Matlick
Alt. Contact: Don Campbell

Address Invoice To:
3.

Address Report To:
2.

Send Invoice To:
4.

Send Report To (1) or 2 (Circle one)
Client project/P.O. #: Verbal
Sample Team Member ('s) Skip Matlick

Lab Job Number: Y 305062
Lab Destination:
Date Samples Shipped:
Lab Contact:
Date Verbals Required:
Date Report Required:
Client Contact PH. No.:
Client Contact Fax No.:

ANALYSIS

Lab Number	Client Sample Identification	Air Volume	Date/ Time Collected	Sample Type *	Pres.	No. of Cont.	Type of Cont.	CYANIDE	TDS, PH, EC, SG, TSS	OIL & GREASE	Comments/Inst., Hazards, etc.
15 A	NCPA CY I		5/15					X			
16 A	NCPA CY I		5/16					X			
17 A	NCPA TDS I		5/15						X		
18 A	NCPA TDS I		5/16						X		
19 A	NCPA OG I		5/15							X	
20 A	NCPA OG I		5/16							X	
21											

		DATE	TIME			DATE	TIME
Relinquished by: (Signature)	Skip Matlick	5/17/93	0927	Received by: (Signature)	C MacLane	5/17/93	9:32
Relinquished by: (Signature)	C MacLane	5/17/93	5:49	Received by: (Signature)	Frank Sacco	5/17/93	5:49
Relinquished by: (Signature)	Frank Sacco	5/17/93	5:49	Received by: (Signature)		DATE	TIME
Method of Shipment				Lab Comments			

* Sample type (Specify): 1) 25 mm 0.45 Um MCEF 2) 25 mm 0.8 Um MCEF 3) 25 mm 0.4 Um polycarb. filter 4) 37 mm 0.8 Um 5) PVC filter diam. _____ pore size _____
6) Charcoal tube 7) Silica gel tube 8) Waste Water 9) Soil 10) Bulk 11) Other_____

COPIES: WHITE - JOB FILE • YELLOW - PROJECT FILE • PINK - CLIENT

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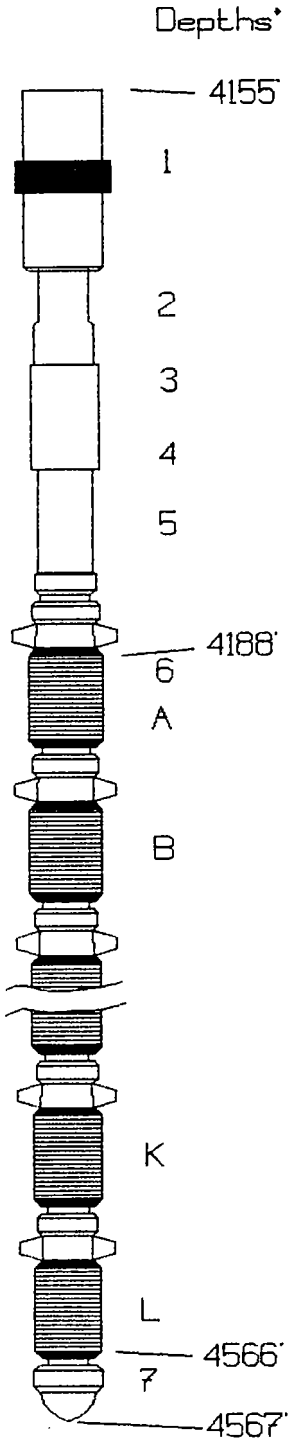
Appendix C

GRAVEL PACK & LINER DESIGN

Figure C-1

NCPA LODI STIG #1

Diagram of Wire-Wrapped Screen Liner Assembly
As-Installed June 5, 1993



Item No.	Length (ft)	O.D. (in)	I.D. (in)	Description
1	4.33	4.21	2.60	SC-1L Gravel Pack Packer 50B-26
2	4.00	3.75		Millout Extension
3	1.41	4.00	2.60	Model "S" G.P. Sliding Sleeve
4	1.03	3.75	2.60	Seal Bore
5	21.10	3.50	2.99	Lower Extension
6	379.18	2.93	1.99	Bakerweld Screen .020 Gauge *
				(2.375" Base Pipe x2.93" Screen O.D.)
7	0.62	2.88		Gravel Pack Bullplug
	411.67			Overall Length

Tally of Bakerweld Screen
Length (ft)
A. 31.87
B. 31.82
C. 31,85
D. 31.89
E. 31.87
F. 31.84
G. 31.90
H. 31.86
I. 31.92
J. 31.88
K. 31.94
L. 28.54

Gravel Pack Data	
Gravel Pack Sand Size:	
12-20 U.S. Mesh	
Gravel Pack Volumes:	
Calculated Volume	22.3 cu.ft.
Pumped Volume	48.0 cu.ft.
Reverse Out	16.0 cu.ft.
Calculated in Place	32.0 cu.ft.

* Depths are based on HLS open hole log date 5/7/93

SIEVE ANALYSIS for NCPA | Date: 05-18-1993

Field: Lodi-Stig | Well: #1 | Depth: | Sample: 05083

Lease: | Formation: | County: | State:

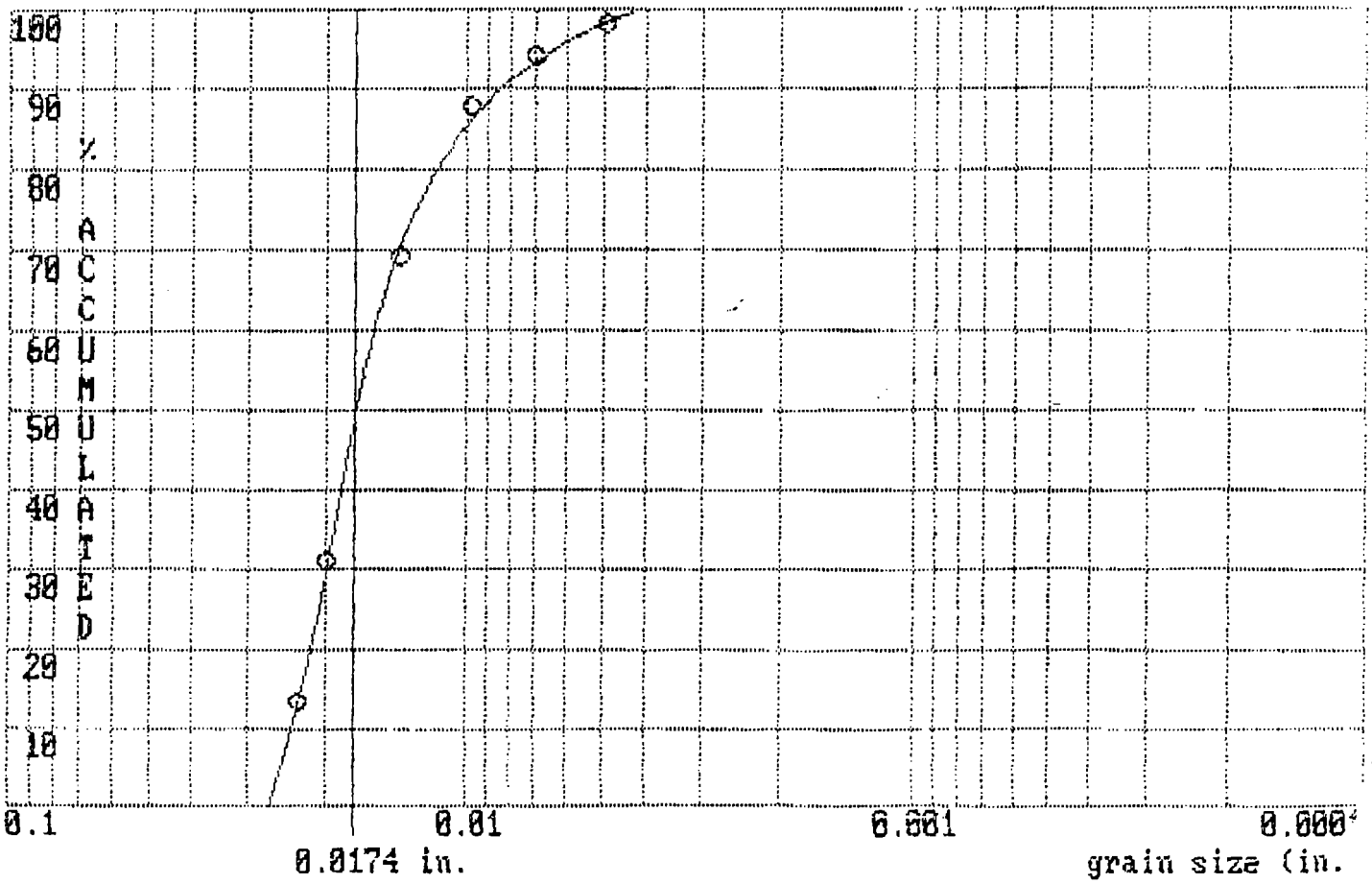
Well Type: | BHT: °F | BHP: psi | Completion Intrvl:

Acid Solubility | 15%HCl: % | 12%HCl/3%HF: % | U/C: n

Sieve #	Sieve Wt.	RUN 1 Total Wt	RUN 1 Sand Wt	RUN 1 Cum. %	RUN 2 Total Wt	RUN 2 Sand Wt	RUN 2 Cum. %	Avg %
30	42.98	44.03	1.05	13.65				13.65
35	41.10	42.45	1.35	31.21				31.21
45	39.09	42.03	2.94	69.44				69.44
60	38.27	39.68	1.41	87.78				87.78
80	35.83	36.34	0.51	94.41				94.41
120	34.89	35.18	0.29	98.18				98.18
Pan	154.51	154.65	0.14					

50% Grain Size Inches	50% Grain Size US MESH	Inches 4X	Inches 8X	US Mesh 4X	US Mesh 8X	Recommended Gravel Size
0.0171	39.915	0.0682	0.1364	11.66	5.82	8-12

Revised to 12-20



Appendix D

INJECTION DATA & FORMATION PROPERTY CALCULATIONS

TABLE D-1

NCPA Lodi STIG #1 Injection Well
Injection Test Pressure and Rate History
June 8, 1993

Time	Injection Rate (gpm)	Pressure @ 4000 ft (psia)	Measured Wellhead Pressure (psig)	Cumulative Gallons Injected	Calculated Pressure at Sandface @ 4400 ft (psia)
10:17:00	0	1698.0	0	0	1872.0
10:19:00	0	1698.0		0	1872.0
10:21:00	0	1698.0		0	1872.0
10:23:00	72	1698.0		0	1869.4
10:23:30	72	1706.0		36	1877.4
10:24:00	72	1711.0		73	1882.4
10:24:30	72	1723.0		108	1894.4
10:25:00	72	1736.0		144	1907.4
10:25:30	72	1763.0		180	1934.4
10:26:00	72	1800.0		217	1971.4
10:26:30	72	1825.0		252	1996.4
10:27:00	72	1837.0		288	2008.4
10:28:00	72	1849.0		360	2020.4
10:29:00	72	1855.0		432	2026.4
10:30:00	72	1867.0	150	504	2038.4
10:31:00	72	1885.0		576	2056.4
10:31:12	72	1891.0		591	2062.4
10:32:00	72	1891.0		648	2062.4
10:33:00	72	1891.0		721	2062.4
10:34:00	72	1890.5		792	2061.9
10:34:30	72	1890.0		828	2061.4
10:34:54	72	1885.0		857	2056.4
10:34:57	72	1897.0		861	2068.4
10:35:00	105	1898.0	200	865	2067.4
10:35:03	105	1942.0		869	2111.4
10:35:21	105	1941.0		901	2110.4
10:35:36	105	1923.0		927	2092.4
10:36:09	105	1923.0		984	2092.4
10:36:45	105	1929.0		1,048	2098.4
10:37:00	105	1929.0	195	1,073	2098.4
10:39:00	105	1929.0		1,284	2098.4
10:40:00	147	1927.0	190	1,389	2093.4
10:40:42	147	1927.0		1,491	2093.4
10:40:54	147	1941.0		1,521	2107.4
10:41:00	147	1912.0		1,535	2078.4
10:41:30	147	1958.0		1,610	2124.4
10:42:00	147	1958.0		1,684	2124.4

TABLE D-1

NCPA Lodi STIG #1 Injection Well
Injection Test Pressure and Rate History
June 8, 1993

Time	Injection Rate (gpm)	Pressure @ 4000 ft (psia)	Measured Wellhead Pressure (psig)	Cumulative Gallons Injected	Calculated Pressure at Sandface @ 4400 ft (psia)
10:42:36	147	1960.0		1,770	2126.4
10:43:00	147	1961.0		1,830	2127.4
10:44:00	147	1961.0	232	1,978	2127.4
10:45:00	210	1961.0		2,124	2121.6
10:45:09	210	1961.0		2,154	2121.6
10:45:13	210	2020.0		2,169	2180.6
10:45:36	210	2006.0	268	2,251	2166.6
10:46:12	210	2004.0		2,375	2164.6
10:46:15	210	1989.0		2,387	2149.6
10:47:00	210	1987.0		2,544	2147.6
10:48:00	210	1989.0		2,753	2149.6
10:49:00	210	1989.0		2,965	2149.6
10:50:00	210	1990.0		3,173	2150.6
10:51:00	210	1993.4		3,385	2154.0
10:52:54	210	1991.0		3,784	2151.6
10:53:09	210	1985.0		3,835	2145.6
10:55:00	210	1985.0		4,223	2145.6
10:57:00	210	1985.0		4,643	2145.6
10:59:00	210	1985.0		5,063	2145.6
11:00:12	210	1985.0	260	5,317	2145.6
11:00:24	210	1981.0		5,357	2141.6
11:01:00	210	1981.0		5,484	2141.6
11:03:00	210	1979.0		5,904	2139.6
11:04:36	210	1979.0		6,240	2139.6
11:05:00	210	1982.0		6,324	2142.6
11:07:00	210	1983.0		6,745	2143.6
11:09:00	210	1983.0		7,165	2143.6
11:10:00	210	1983.0	258	7,374	2143.6
11:10:12	210	1978.0		7,416	2138.6
11:11:00	210	1978.0		7,585	2138.6
11:12:00	210	1977.0		7,794	2137.6
11:15:00	210			8,424	
11:30:00	210		268	11,575	
11:33:00	210			12,204	
11:50:00	210		265	15,775	
12:00:00	210		272	17,874	
12:03:00	210			18,503	

TABLE D-1

NCPA Lodi STIG #1 Injection Well
Injection Test Pressure and Rate History
June 8, 1993

Time	Injection Rate (gpm)	Pressure @ 4000 ft (psia)	Measured Wellhead Pressure (psig)	Cumulative Gallons Injected	Calculated Pressure at Sandface @ 4400 ft (psia)
12:15:00	210		273	21,025	
12:30:00	210			24,173	
13:00:00	210			30,475	
13:11:00	210		285	32,785	
13:30:00	210			36,774	
13:50:00	210		285	40,974	
13:53:00	210			41,603	
14:01:36	210	2002.2		43,411	2162.8
14:02:00	210	2002.0		43,495	2162.6
14:03:00	210	2002.0		43,704	2162.6
14:04:00	210	2002.2		43,913	2162.8
14:05:00	210	2002.2		44,124	2162.8
14:06:03	126	2002.2		44,345	2170.2
14:06:04	126	1992.0		44,347	2160.0
14:06:09	126	1990.0		44,358	2158.0
14:06:11	126	1942.0		44,361	2110.0
14:06:15	126	1907.0		44,370	2075.0
14:06:24	126	1892.0		44,389	2060.0
14:06:26	126	1881.0		44,392	2049.0
14:06:48	126	1878.0		44,439	2046.0
14:07:12	126	1883.0		44,490	2051.0
14:07:36	126	1886.0		44,539	2054.0
14:08:00	126	1890.0		44,590	2058.0
14:08:24	126	1892.0		44,641	2060.0
14:08:48	126	1893.0		44,692	2061.0
14:09:12	126	1894.0		44,742	2062.0
14:10:00	126	1895.5		44,842	2063.5
14:11:00	126	1898.0		44,969	2066.0
14:12:00	126	1900.0		45,094	2068.0
14:14:00	126	1902.0		45,347	2070.0
14:16:00	126	1904.0		45,599	2072.0
14:18:00	126	1906.0	185	45,851	2074.0
14:20:00	126	1908.0		46,103	2076.0
14:22:00	126	1910.0		46,354	2078.0
14:28:00	126		194	47,111	
14:30:00	126			47,363	
14:52:00	126	1922.0		50,135	2090.0

TABLE D-1

NCPA Lodi STIG #1 Injection Well
Injection Test Pressure and Rate History
June 8, 1993

Time	Injection Rate (gpm)	Pressure @ 4000 ft (psia)	Measured Wellhead Pressure (psig)	Cumulative Gallons Injected	Calculated Pressure at Sandface @ 4400 ft (psia)
14:52:48	126	1923.0		50,235	2091.0
14:52:53	126	1926.3		50,245	2094.3
14:54:00	126	1927.3		50,387	2095.3
14:55:00	126	1928.0		50,512	2096.0
14:55:12	126	1928.0		50,538	2096.0
14:55:24	126	1927.0		50,563	2095.0
14:56:00	126	1927.0		50,639	2095.0
14:58:00	126	1927.0		50,890	2095.0
15:00:00	126	1928.0	205	51,142	2096.0
15:02:00	126	1928.0		51,394	2096.0
15:04:00	126	1928.5		51,646	2096.5
15:04:36	126	1928.5		51,722	2096.5
15:05:00	126	1928.5		51,773	2096.5
15:05:12	126	1928.3		51,797	2096.3
15:06:00	126	1928.0		51,898	2096.0
15:07:01	126	1928.8		52,025	2096.8
15:08:00	126	1929.0		52,151	2097.0
15:08:48	126	1930.0		52,250	2098.0
15:09:00	126	1930.0		52,276	2098.0
15:10:00	126	1930.0		52,403	2098.0
15:10:24	120	1925.0		52,454	2093.4
15:11:00	100	1893.5		52,524	2063.3
15:12:00	0	1831.0		52,625	2005.0
15:12:12		1794.0		52,625	1968.0
15:12:24		1761.0		52,625	1935.0
15:12:36		1742.0		52,625	1916.0
15:12:48		1730.5		52,625	1904.5
15:13:00		1726.5		52,625	1900.5
15:13:12		1723.0		52,625	1897.0
15:13:36		1720.5		52,625	1894.5
15:14:00		1717.2		52,625	1891.2
15:14:24		1716.0		52,625	1890.0
15:14:36		1714.0		52,625	1888.0
15:14:48		1712.2		52,625	1886.2
15:15:00		1711.3		52,625	1885.3
15:15:24		1709.2		52,625	1883.2
15:15:48		1707.0		52,625	1881.0

TABLE D-1

NCPA Lodi STIG #1 Injection Well
Injection Test Pressure and Rate History
June 8, 1993

Time	Injection Rate (gpm)	Pressure @ 4000 ft (psia)	Measured Wellhead Pressure (psig)	Cumulative Gallons Injected	Calculated Pressure at Sandface @ 4400 ft (psia)
15:16:12		1705.9		52,625	1879.9
15:16:36		1650.9		52,625	1824.9
15:17:00		1703.5		52,625	1877.5
15:17:24		1702.8		52,625	1876.8
15:17:48		1702.0		52,625	1876.0
15:18:12		1701.1		52,625	1875.1
15:19:00		1700.9		52,625	1874.9
15:19:24		1700.0		52,625	1874.0
15:19:48		1700.0		52,625	1874.0
15:20:12		1699.8		52,625	1873.8
15:20:36		1699.1		52,625	1873.1
15:21:00		1699.0		52,625	1873.0
15:22:00		1698.2		52,625	1872.2
15:27:00		1698.0		52,625	1872.0
15:32:00		1698.0		52,625	1872.0
15:37:00		1698.0		52,625	1872.0
15:42:00		1698.0		52,625	1872.0
15:47:00		1698.0		52,625	1872.0
15:52:00		1698.0		52,625	1872.0
15:57:00		1698.0		52,625	1872.0

Horner Analysis

$$slope = m = 55 \frac{psig}{\log\ cycle}$$

$$kh = 162.6 \frac{qB\mu}{m}$$

$$kh = \frac{(162.6)(4320.5)(1.0)(0.98)}{55} = 12517\ md.ft$$

$$Assume \quad h = 230\ feet \quad \Rightarrow \quad k = 54.4\ md$$

$$s = 1.1513\left[\frac{P_{1hr} - P_{\Delta t=0}}{m} - \log\left(\frac{k}{\phi\mu c_t r_w^2}\right) + 3.2275\right]$$

$$s = 1.1513\left[\frac{1829 - 2098}{(-55)} - \log\left(\frac{54.4}{(0.29)(0.98)(7.5E-06)(0.5)^2}\right) + 3.2275\right]$$

$$s = 0.11$$

Steady State Analysis

$II = 0.537\ gpm/psi \quad (18.3\ bpd/psi\ )$

$$r_{inv} = \sqrt{\frac{0.000264kt}{0.25\phi\mu c_t}}$$

$$r_{inv} = \sqrt{\frac{0.000264(54.4)(5)}{0.25(0.29)(0.98)(7.5E-06)}} = 367\ feet$$

$$q = \frac{0.007082kh(P_e - P_w)}{B\mu\ln(r_e/r_w)}$$

$$\frac{q}{(P_e - P_w)} = II = \frac{0.007082kh}{B\mu\ln(r_e/r_w)}$$

$$kh = II\left[\frac{B\mu\ln(r_e/r_w)}{0.007082}\right]$$

$$kh = (18.3)\frac{(1.0)(0.98)\ln(367/0.5)}{0.007082} = 16709\ md\ ft$$

$Assume \quad h = 230\ feet \ \Rightarrow \ k = 72.6\ md$

Appendix E

WATER SHUTOFF TEST & CONFINING LAYER LEAKOFF TEST DATA

ATTACHMENT L

CONSTRUCTION PROCEDURES

L.1 Drilling/Construction History

The STIG #1 well was drilled, tested and completed during the time period beginning April 29 and ending June 9, 1993. These operations were performed under regulations issued by the Resource Agency of California, Department of Conservation, Division of Oil and Gas, in accordance with specific provisions contailed in a Permit issued to NCPA for these purposes on February 9, 1993. A copy of the completed forms and all documents filed with or issued by the CDOG for the STIG #1 well, including the "Notice of Intention to Drill New Well", the "Permit to Conduct Well Operations", three "Report on Well Operations", the "Well Summary Report", and the "Well History", are included as Item #1 in Appendix L.

The daily cronicle of the operations as reported in the Well History to the CDOG is as follows:

STIG #1 WELL: HISTORY OF DRILLING, TESTING AND COMPLETION

1993

Apr 29 MIRU Paul Graham Rig #2, Tex Hillmon, tool pusher. Spudded in at 4:00PM through 16" Conductor previously set at 30'. Drilled 14-3/4" hole to 614'. Wiped hole, surveyed and POOH to run casing. Survey @ 614'= 1.5 deg.

Apr 30 Rigged up and ran 16 jts 10-3/4" 40.5# K-55 ST&C casing to 611'. Circulated hole clean. BJ pumped 10 bbls water ahead, mixed and pumped 180 sx "G" cmt w/ 4% Gel, 10#/sx A-10, 3% A-7 & 0.2% FP8 followed by 150 sx "G" cmt w/3% $CaCl_2$. Bumped plug w/ 500 psi. CIP @ 3:00AM w/ good returns to surface. WOC 2hrs. Cut off 10-3/4" csg & welded on 10" wellhead. Tested wellhead to 1000 psi. Nippled up BOP and tested blind rams to 1000 psi. Made up BHA and RIH. Tested pipe rams to 1000 psi, witnessed by D.O.G. Drilled out cement and shoe. Rigged up EnergyLog Mudlogging Services (Ben Cahill). Drilled 9-7/8" hole to 1170'. Surveys: @ 1130'= 15min.

May 1 Drilled 9-7/8" hole from 1170′ to 3154′. Surveys: @ 1439′=15min, @ 1792′=15min, @ 2109′=30min, @ 2554′= 45 min, @ 2966′=30min.

May 2 Drilled 9-7/8" hole from 3154′ to 3675′. Surveys: @3340′=15min, @ 3675′=45min. Circulated and conditioned hole for electric logging. Halliburton ran Dual Induction-Density-Neutron-Gamma Ray-Caliper Log from 3670′ to 611′. RIH.

May 3 Circulated and conditioned hole to run casing, POOH. Ran 86 jts of 7" 20# K-55 ST&C casing to 3660′. Circ hole clean. BJ pumped 10 bbls water ahead, mixed and pumped 370 cu ft "G" cement w/ 35% fly ash, 6% gel and 2% $CaCl_2$. Had mixer failure while pumping slurry, circ out cement to surface w/ rig pump. Circ and cond mud. BJ pumped 18 bbls clean mud and 5 bbls water ahead, mixed and pumped 1106 cu ft "G" cmt w/ 35% fly ash, 6% gel and 2% $CaCl_2$ followed by tail of 168 cu ft "G" cmt w/ 1% $CaCl_2$. No circ during displacement. CIP @ 1940 hrs, WOC.

May 4 WOC 22 hrs total. Rigged up and ran Halliburton MSG Neutron Casing Collar and Cement Bond Log from 3586′ to 450′. Top of cement at 700′. Tore out BOP.

May 5 Cut off 10-3/4" wellhead. Welded on 11" 3M X 10-3/4" wellhead and set 7" casing slips at 20,000 psi in wellhead. Installed 11" 3M X 7-1/16" 3M tubing head and tested packing to 1500 psi. Nippled up BOP. Tested blind rams @1000 psi. Picked up 4-3/4" DC and 6-1/4" bit, RIH, tested pipe rams @ 1000 psi, witnessed by D.O.G. RIH, cleaned out cement and drilled 2′ to 3677′, circ and POOH. Made up Halliburton Drill Stem Test Tools, RIH to 3550′ and set packer.

May 6 Opened test tool at 0004hrs, weak blow, dead after 15 min. Shut in for 1 hr (210′ of drill mud later found in drill stem). Opened test packer and performed leak off test. At 200 psig (surface pressure) no leak off, at 325 psi minor leak off, at 410 psi minor leak off, at 525 psi leak off to 475 psi in 20 min. Pulled out tester. Made up BHA and RIH to 3677′. Circ and cond mud. Drilled 6-1/4" hole to 4350′.

May 7 Drilled from 4350′ to total depth of 4650′. Survey @4650′ =1.5 deg. Circ and conditioned mud for E-logs, POOH. Halliburton ran Dual Induction-Density-Neutron

May 7 (contin'd) -Gamma Ray Caliper Log from 4640' to 3660'. RIH and circulated and conditioned mud for liner, POOH.

May 8 Ran 1287' of 5" 15# K-55 ST&C liner, with shoe at 4645', float collar at 4599' and top of hanger at 3358'. Halliburton pumped 20 bbls mud flush ahead, mixed and pumped 187 cu ft "G" cmt w/ 350# KCl and 157# 322. Displaced w/ 48.4 bbls water. CIP @0510 hrs, backed out of liner hanger and POOH. WOC 12 hrs. RIH, top cement at 3111'. Cleaned out cement w/ 6-1/4" bit to top of liner hanger at 3358'. Tested liner lap to 500 psi, witnessed by D.O.G, POOH.

May 9 Picked up BHA w/ 4-1/4" bit, RIH and cleaned out cement from 3358' to 3388', RIH, CO cmt from 4573' to 4602'. Circulated clean with mud. Cleaned out mud tanks and mixed 6% KCl water. Displaced drilling mud in hole w/ KCl water @1100 hrs. POOH, laid down drill pipe. Tore out BOP, installed cap and valves on tubing head. Released rig at 1800 hrs. (no operations on May 10)

May 11 Moved out Paul Graham Drilling Rig #2, MIRU Paul Graham Production/Completion Rig #3

May 12 Rigged up Prime Perforating and Flo-Log, RIH and recorded Temperature Log (#1) from 100' to 4596', POOH. RIH and recorded Gamma Ray-Casing Collar Location Log, POOH. RIH w/ perforating gun, shot four 11 gram jet shots/ft, 120 deg phasing (0.31"diam, 18.9" penetration) in following intervals:

Run No.	Interval	Feet
1	4565'-4573'	8
2	4528'-4538'	10
3	4501'-4507'	6
4	4495'-4501'	6
5	4474'-4495'	21
6	4453'-4474'	21
7	4432'-4453'	21

Found sand fill @ 4458'. 30 minutes later, tagged fill at 4427'. Skipped perforating intended 4411'-4432' interval.

8	4390'-4411'	21

Shut down and secured well.

May 13 RIH and tagged top of sand fill at 4395′, resumed perforating operations.

Run No.	Interval	Feet	
9	4373′-4379′	6	
10	4352′-4373′	21	Tagged fill @ 4395′
11	4331′-4352′	21	
12	4316′-4326′	10	Tagged fill @ 4382′
13	4312′-4316′	4	
14	4296′-4306′	10	
15	4267′-4288′	21	
16	4244′-4254′	10	
17	4234′-4239′	5	Tagged fill @ 4311′
	Total Perforated:	222′	

Rigged down and released Prime. Filled hole, closed blind rams and injected 5 bbls @ 1 bbl/min. Pressure increased to 250 psi, shut down pump. Ordered out coiled tubing unit and nitrogen for underbalance cleanout circulation.

May 14 Prepared for cleaning sand out of 5" liner.

May 15 MIRU Halliburton 1-1/2" coil tubing unit, liquid nitrogen unit and pump truck. Staged in hole unloading KCl water w/ N2, cleaned out soft sand fill from 4320′ to 4564′, and used N2 and 1 bbl/min water to clean out hard fill from 4564′ to 4590′. Continued to produce and filter well water until 1341 bbls of water was stored in Baker tanks for scheduled injection test. Collected final formation water samples for analysis. POOH, rigged down units.

May 16 Rigged up Flo-Log, RIH and found sand fill at 4108′ (126′ above perfs). POOH, closed blind rams, pressured up to 450 psi, confirmed fill was packing off perforated liner. Rigged down, released all equipment and ordered wire screen sand control inner liner.

June 1 Resumed operations after having suspended work on May 16. MIRU Paul Graham Production/Completion Rig #3. Nippled up BOP, made up 7" casing scraper and BHA, picked up 2-3/8" tubing running in hole.

June 2 RIH with 7" casing scraper to top of liner hanger at 3358′, POH. Made up BHA w/ 4-1/4" bit, RIH to top of sand fill at 4102′, rigged up Halliburton cartridge filter unit and circulated out sand from 4102′ to 4220′. Pulled up 15 stands, secured well.

June 3 RIH and tagged fill at 4221′, POH and picked up 5" casing scraper, RIH and scrapped casing to 4218′, POOH. Picked up 4-1/2" bit, RIH and cleaned out sand to 4242′ with water, lost circulation. Mixed polymer to 150 vis, cleaned out to 4424′ losing 20 to 30 bbls/hr. Pulled up 20 stands, secured well.

June 4 RIH and tagged fill at 4400′, cleaned out sand to 4602′. Cir hole clean, POH. After 30 min, RIH and tagged fill at 4598′, cleaned out to 4602′, cir hole clean, pulled up to 3350′, secured well.

June 5 RIH and tagged fill at 4501′, cleaned out sand to 4602′. Mixed and circulated 33 bbl high vis pill w/ Baker Sand Control, cleaned out wellbore. POH to 3363′, changed over to 3% KCl water, circulated, POOH. Made up and ran 412′ of Baker 2-3/8" x 2-15/16" OD screened liner, tagged fill at 4575′, hung liner as follows:

4155′ to 4159′	SC1-L 50B-26 Packer
4159′ to 4163′	Upper Extension (3.75" OD)
4163′ to 4165′	Sliding Sleeve (4.00" OD)
4165′ to 4166′	Seal Bore (3.75" OD)
4166′ to 4187′	Lower Extension (3.75" OD)
4187′ to 4566′	Wire Wrap Screen (2.93"OD, 1.99"ID)
4566′ to 4567′	Bull Plug

Gravel packed annulus between screened liner and 5" liner with 28 cu ft of 12-20 mesh sand, equal to 126% of the calculated annulus volume. Secured rig.

June 6 RIH, re-packed with 4 cu ft of additional gravel pack (total of 32 cu ft = 143.5% of cal vol). After 2 hrs, restressed gravel pack, pressured up to 2000 psi. POOH. Laid down tubing, setting tools, installed spool and valve on top of BOP. Secured well.

June 7 Prepared for injection test, rig mixed polymer breaker to lower viscosity of polymer in Baker storage tank, waited for delayed Flo-Log equipment to arrive on site.

June 8 Rigged up Flo-Log and ran Temperature/Pressure/Spinner tool, recording static Temperature Log (#2) from surface to 4567′. Pulled tool up to 4000′ and recorded static pressure. Began injection test of about 5 hours duration, with injection rates rapidly increased in steps from an initial rate of 2 bbls/min (84 gpm) to 5

June 8 (contn'd) bbls/min (210 gpm), maintaining 5 bbls/min for 3 hrs 10 min, and then reducing to 3 bbls/min for 1 hr until a total volume of 1,253 bbls (52,625 gals) was injected. Flo-Log had recorded multiple spinner logs throughout the injection interval during both the 5 and final 3 bbls/min injection rate periods, had made R/A tracer surveys across the 7"x5" liner lap and above the top perforations. Flo-Log then hung their instruments at 4000' and recorded the pressure fall-off history for 50 minutes after shutin. Finally, recorded a Noise Log over the 500' to 1200' interval. Rigged down and secured well.

June 9 Rigged up and ran 77 jts of 10.5# J-55 4-1/2" tubing and Baker Large Bore Lok-Set retrievable packer (Model Number AL-2), setting packer at 3342' after filling annulus with 80 bbls clear water with Amberguard 425 corrosion inhibitor and 3% KCl. Landed and locked down donut on tubing head and tested packer at 1000 psi for 30 min. Nippled up 4-1/8" 2000 series valve on tubing head and injected 80 bbls clear water with Amberguard 425 and 3% KCl down 4-1/2" tubing. Released rig and secured well at 1430 hrs on June 9, 1993.

L.2 Casing Programs

The casing programs followed were to set 10-3/4" casing to 611', 7" casing to 3660', and 5" casing to 4645'. Details as to casing weights, grade, etc are contained in the above drilling history.

L.3 Cementing Programs

A description of the program and materials used to cement each of the three cemented casing strings installed in the STIG #1 well are also included in the drilling history information.

L.4 Annular Fluid

After the well was completed the annular fluid described during the June 9 entry of the above daily cronicle was placed into the annular space between the 4-1/2" tubing and 7" casing strings, and throughout the inside wellbore.

APPENDIX 11

Plugging and Abandonment Approach and Cost Estimate

Northern California Power Agency
180 Cirby Way
Roseville, California 95678

STIG #1

San Joaquin County, California
United States of America
S:24 T:3N R:5E

Plug to Abandon Cementing Services Proposal

Prepared for: Frank Carter
March 1, 2005
Version: 1

Submitted by:
Marc Brennen
Halliburton Energy Services
1990 Hays Lane
Woodland, California 95776
530 666-0233

HALLIBURTON

HALLIBURTON

Halliburton appreciates the opportunity to present this proposal and looks forward to being of service to you.

Foreword

Frank,

Enclosed is current pricing and our recommended procedure for mixing and pumping cement plugs in the STIG # 1 well at the Lodi Power Facility in San Joaquin County, California. The information in this proposal includes well data, calculations, materials requirements, and cost estimates. This proposal is based information supplied to our office, our previous telephone conversations and previous successful cementing services in the area.

In order to help maintain high quality service and insure that we can have equipment and personnel available, we need a minimum 48 hours notice of the award of work.

Halliburton Energy Services recognizes the importance of meeting society's needs for health, safety, and protection of the environment. It is our intention to proactively work with employees, customers, the public, governments, and others to use natural resources in an environmentally sound manner while protecting the health, safety, and environmental processes while supplying high quality products and services to our customers.

We appreciate the opportunity to present this proposal for your consideration and we look forward to being of service to you. Our Services for your well will be coordinated through the Service Center listed below. If you require any additional information or additional designs, please feel free to contact myself or our field representative listed below.

Prepared and Submitted by: _____

Marc Brennen
Principal Technical Professional

SERVICE CENTER:	WOODLAND, CALIFORNIA
SERVICE COORDINATOR:	DALE CRAWFORD OR WILLIE HENDERSON
OPER. ENGINEER:	MARC BRENNEN OR HAMID NAJAFI
PHONE NUMBER:	O. 530 666-0233 C. 530 219-3650

Job Information — Plug to Abandon

STIG 1

2-3/8" Tubing	0 - 3367 ft (MD)
	0 - 3367 ft (TVD)
Outer Diameter	2.375 in
Inner Diameter	1.995 in
Linear Weight	4.70 lbm/ft
Tubing Grade	N-80
1-1/4" Tubing	3367 - 4567 ft (MD)
	3367 - 4567 ft (TVD)
Outer Diameter	1.250 in
Inner Diameter	0.824 in
Linear Weight	2.40 lbm/ft
Tubing Grade	N-80
7" Intermediate Casing	0 - 3660 ft (MD)
	0 - 3660 ft (TVD)
Outer Diameter	7.000 in
Inner Diameter	6.456 in
Linear Weight	20 lbm/ft
Casing Grade	K-55
5" Liner	3358 - 4645 ft (MD)
	3358 - 4645 ft (TVD)
Outer Diameter	5.000 in
Inner Diameter	4.408 in
Linear Weight	15 lbm/ft
Casing Grade	K-55
Cement Plug # 2	100 ft (MD)
Job Excess	100 %
Mud Type	Water Based Mud
Mud Weight	8.34 lbm/gal
BHST	125 degF @ 4645'
BHCT	105 degF

Plug 1

Spacer:

609.09 ft * 0.2273 ft^3/ft * 0 %	= 138.46 ft^3
Total Spacer	= 138.46 ft^3
	= 24.66 bbl

Cement : (1895.56 ft fill)

686.56 ft * 0.2273 ft^3/ft * 0 %	= 156.07 ft^3
1209.00 ft * 0.106 ft^3/ft * 0 %	= 128.13 ft^3
Plug Cement	= 284.20 ft^3
	= 50.62 bbl

Total Pipe Capacity: (4567.00 ft MD) = 34.51 ft^3

Plug 2

Spacer:

0.00 ft * 0.0 ft^3/ft * 0 %	= 0.00 ft^3
Total Spacer	= 0.00 ft^3
	= 0.00 bbl

Cement : (100.00 ft fill)

100.00 ft * 0.2273 ft^3/ft * 100 %	= 45.46 ft^3
Plug Cement	= 45.46 ft^3
	= 8.09 bbl

Total Pipe Capacity: (100.00 ft MD) = 2.17 ft^3

Fluid Instructions

Plug 1

Fluid 1: Water Based Spacer

FRESH WATER

Fluid Density:	8.34 lbm/gal
Total Volume:	24.66 bbl
Volume Ahead:	22.21 bbl

Fluid 2: Plug Cement

Premium Hi-Temp Westcoast

		Fluid Weight	15.80 lbm/gal
94 lbm/sk	Premium Hi-Temp Westcoast (Cement-api)	Slurry Yield:	1.16 ft^3/sk
0.5 %	CFR-3 (Dispersant)	Total Mixing Fluid:	5.00 Gal/sk
1 %	Calcium Chloride Pellets (Accelerator)	Top of Fluid:	2671.44 ft
		Calculated Fill:	1895.56 ft
		Volume:	280 cubic feet
		Volume:	49.86 bbls
		Proposed Sacks:	245 sks

Fluid 3: Water Based Spacer

FRESH WATER

Fluid Density:	8.34 lbm/gal
Total Volume:	24.66 bbl
Volume Behind:	2.45 bbl

Cement Plug # 2 100 ft (MD)

Plug 2

Fluid 1: Water Based Spacer

FRESH WATER

Fluid Density:	8.34 lbm/gal
Total Volume:	2 bbl
Volume Ahead:	2 bbl

Fluid 2: Plug Cement

Premium Hi-Temp Westcoast

		Fluid Weight	15.80 lbm/gal
94 lbm/sk	Premium Hi-Temp Westcoast (Cement-api)	Slurry Yield:	1.18 ft^3/sk
0.5 %	CFR-3 (Dispersant)	Total Mixing Fluid:	5.03 Gal/sk
3 %	Calcium Chloride Pellets (Accelerator)	Top of Fluid:	0 ft
		Calculated Fill:	100 ft
		Volume:	7.78 bbl
		Calculated Sacks:	38 sks
		Proposed Sacks:	38 sks

Fluid 3: Displace

FRESH WATER

Fluid Density:	8.34 lbm/gal
Total Volume:	bbl
Volume Behind:	bbl

Detailed Pumping Schedule

Fluid #	Fluid Type	Fluid Name	Surface Density lbm/gal	Estimated Avg Rate bbl/min	Downhole Volume
Plug 1					
1	Spacer	FRESH WATER	8.3	2.0	22.21 bbl
2	Cement	WEST COAST HIGH TEMP CEMENT + 0.5% CFR-3 + 1% CACL2	15.8	3.0	245 sks
3	Spacer	FRESH WATER	8.3	3.0	2.45 bbl
Plug 2					
1	Spacer	FRESH WATER	8.3	2.0	2 bbl
2	Cement	WEST COAST HIGH TEMP CEMENT + 0.5% CFR-3 + 3% CACL2	15.8	3.0	38 sks
3	Spacer	FRESH WATER	8.3		0 bbl

HALLIBURTON

Cost Estimate — *Plug to Abandon*

SAP Quote #0

Mtrl Nbr	Description	Qty	U/M	Unit Price	Gross Amt	Net Amt
7528	CMT PLUG TO ABANDON BOM	1		0.00	0.00	0.00
16094	PLUG BACK/SPOT CEMENT OR MUD,ZI	1	EA	5,615.00	5,615.00	5,615.00
	DEPTH	4567	FT			
16096	Plugging Back, EA ADD HR, ZI	1	EA	749.00	8,988.00	8,988.00
	HOURS	12				
8	IRON SAFETY INSPECTION SURCHARGE /JOB ZI	1	JOB	58.00	58.00	58.00
	PLUG # 1					
101250222	CEM, WESTCOAST PREM HI-TEMP CEMENT, BULK	245	SK	33.30	8,158.50	8,158.50
100003653	CHEMICAL - CFR-3 - 50 LB SACK	116	LB	10.28	1,192.48	1,192.48
101299981	CALCIUM CHLORIDE PELLETS	5	LB	125.87	629.35	629.35
	PLUG # 2					
101250222	CEM, WESTCOAST PREM HI-TEMP CEMENT, BULK	38	SK	33.30	1,265.40	1,265.40
100003653	CHEMICAL - CFR-3 - 50 LB SACK	18	LB	10.28	185.04	185.04
101299981	CALCIUM CHLORIDE PELLETS	2	LB	125.87	251.74	251.74
	EQUIPMENT MOB & BULK MATLS. DELIVERY					
2	MILEAGE FOR CEMENTING CREW,ZI	120	MI	3.86	463.20	463.20
	Number of Units	1				
1	ZI-MILEAGE FROM NEAREST HES BASE,/UNIT	120	MI	6.56	787.20	787.20
	Number of Units	1				
76400	ZI MILEAGE,CMT MTLS DEL/RET MIN	60	MI	2.24	1,694.78	1,694.78
	NUMBER OF TONS	12.61				
3965	HANDLE&DUMP SVC CHRG, CMT&ADDITIVES,ZI	273	CF	3.68	1,004.64	1,004.64
	NUMBER OF EACH	1				
	Estimated Total			USD		**30,293.33**

Conditions

NOTE

The cost in this analysis is good for the materials and/or services outlined within. These prices are based on Halliburton being awarded the work on a first call basis. Prices will be reviewed for adjustments if awarded on 2nd or 3rd call basis and/or after 30 days of this written analysis. This is in an effort to schedule our work and maintain a high quality of performance for our customers.

The unit prices stated in the proposal are based on our current published prices. The projected equipment, personnel, and material needs are only estimates based on information about the work presently available to us. At the time the work is actually performed, conditions then existing may require an increase or decrease in the equipment, personnel, and/or material needs. Charges will be based upon unit prices in effect at the time the work is performed and the amount of equipment, personnel, and/or material actually utilized in the work. Taxes, if any, are not included. Applicable taxes, if any, will be added to the actual invoice.

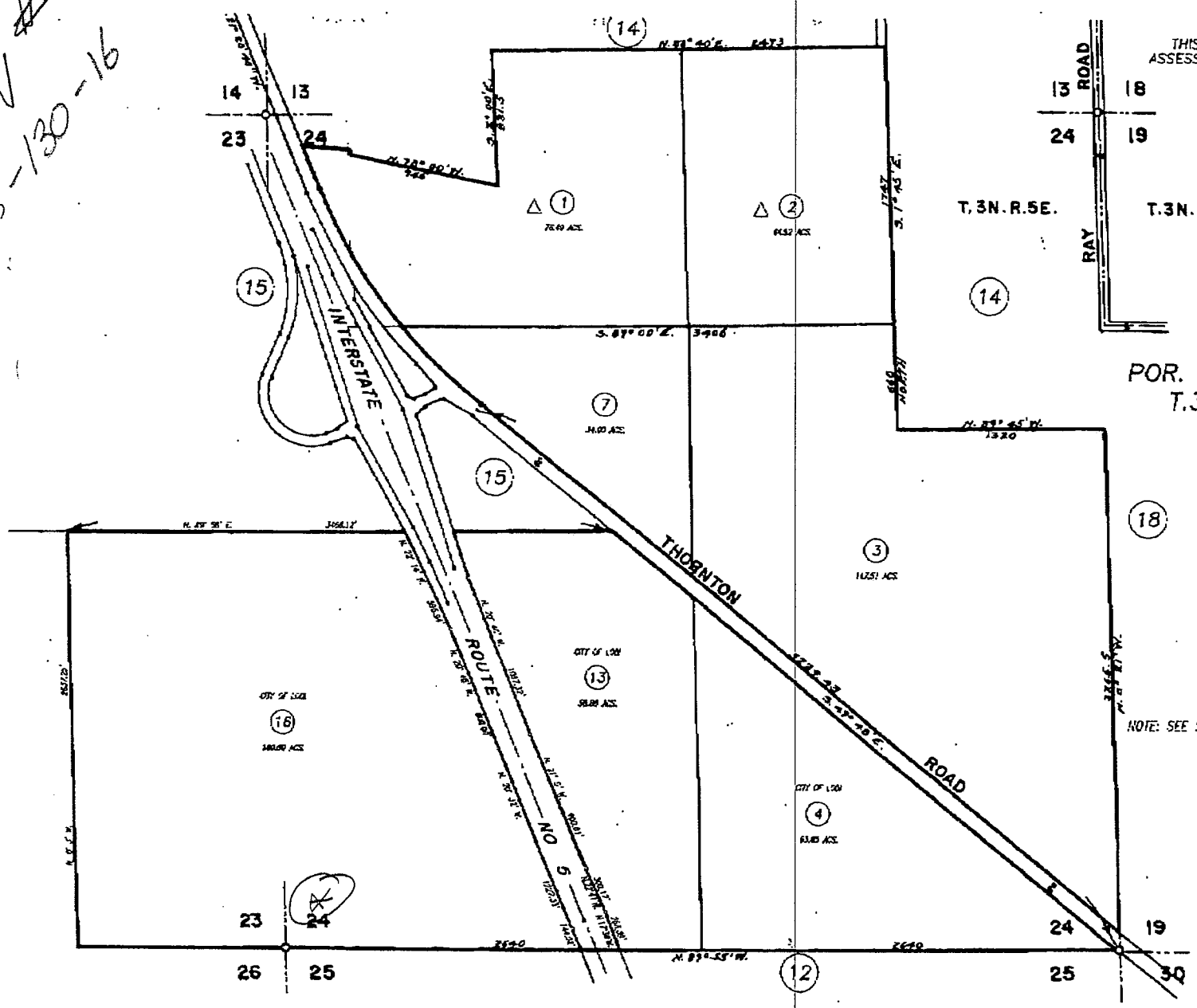
It is understood and agreed between the parties that with the exception of the subject discounts, all services performed and equipment and materials sold are provided subject to Halliburton's General Terms and Conditions contained in our current price list, (which include LIMITATION OF LIABILITY and WARRANTY provisions), and pursuant to the applicable Halliburton Work Order Contract (whether or not executed by you), unless a Master Service and/or Sales Contract applicable to the services, equipment, or materials supplied exists between your company and Halliburton, in which case the negotiated Master Contract shall govern the relationship between the parties. A copy of the latest version of our General Terms and Conditions is available from your Halliburton representative or at: http://www.halliburton.com/hes/general_terms_conditions.pdf for your convenient review, and we would appreciate receiving any questions you may have about them. Should your company be interested in negotiating a Master Contract with Halliburton, our Law Department would be pleased to work with you to finalize a mutually agreeable contract. In this connection, it is also understood and agreed that Customer will continue to execute Halliburton usual field work orders and/or tickets customarily required by Halliburton in connection with the furnishing of said services, equipment, and materials.
Any terms and conditions contained in purchase orders or other documents issued by the customer shall be of no effect except to confirm the type and quantity of services, equipment, and materials to be supplied to the customer.
If customer does not have an approved open account with Halliburton or a mutually executed written contract with Halliburton, which dictates payment terms different than those set forth in this clause, all sums due are payable in cash at the time of performance of services or delivery of equipment, products, or materials. If customer has an approved open account, invoices are payable on the twentieth day after date of invoice.

Customer agrees to pay interest on any unpaid balance from the date payable until paid at the highest lawful contract rate applicable, but never to exceed 18% per annum. In the event Halliburton employs an attorney for collection of any account, customer agrees to pay attorney fees of 20% of the unpaid account, plus all collection and court costs.

APN # 055-130-16

THIS MAP IS FOR ASSESSMENT USE ONLY

055-13



POR. OF SEC. 13, 23 & 24
T.3N. R.5E., M.D.B.&M.

△ – WILLIAMSON ACT PARCELS

HIGHEST A.P.N. USED			
YEAR	PAR. #	PAR. #	PAR. #
04-05	16		

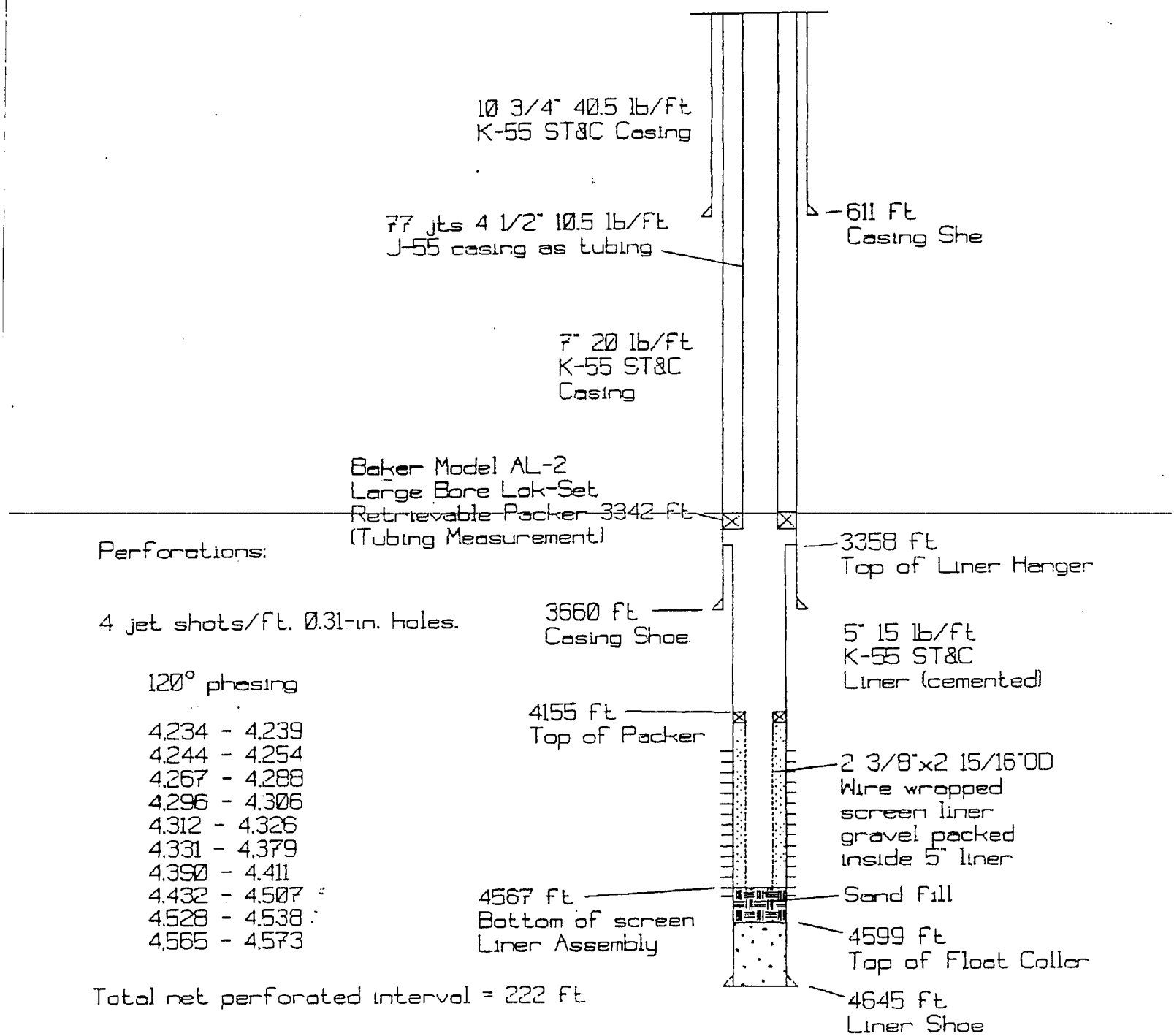
NOTE: SEE SURVEY C-1050

NOTE: Assessor's Parcel Numbers Shown in Circles.
Assessor's Block Numbers Shown in Ellipses.

CITY OF LODI
Assessor's Map Bk.055 Pg.13
County of San Joaquin, Calif.

Figure 1

Well Diagram
NCPA Lodi STIG #1 Injection Well
June 9, 1993, Final Completion



Perforations:

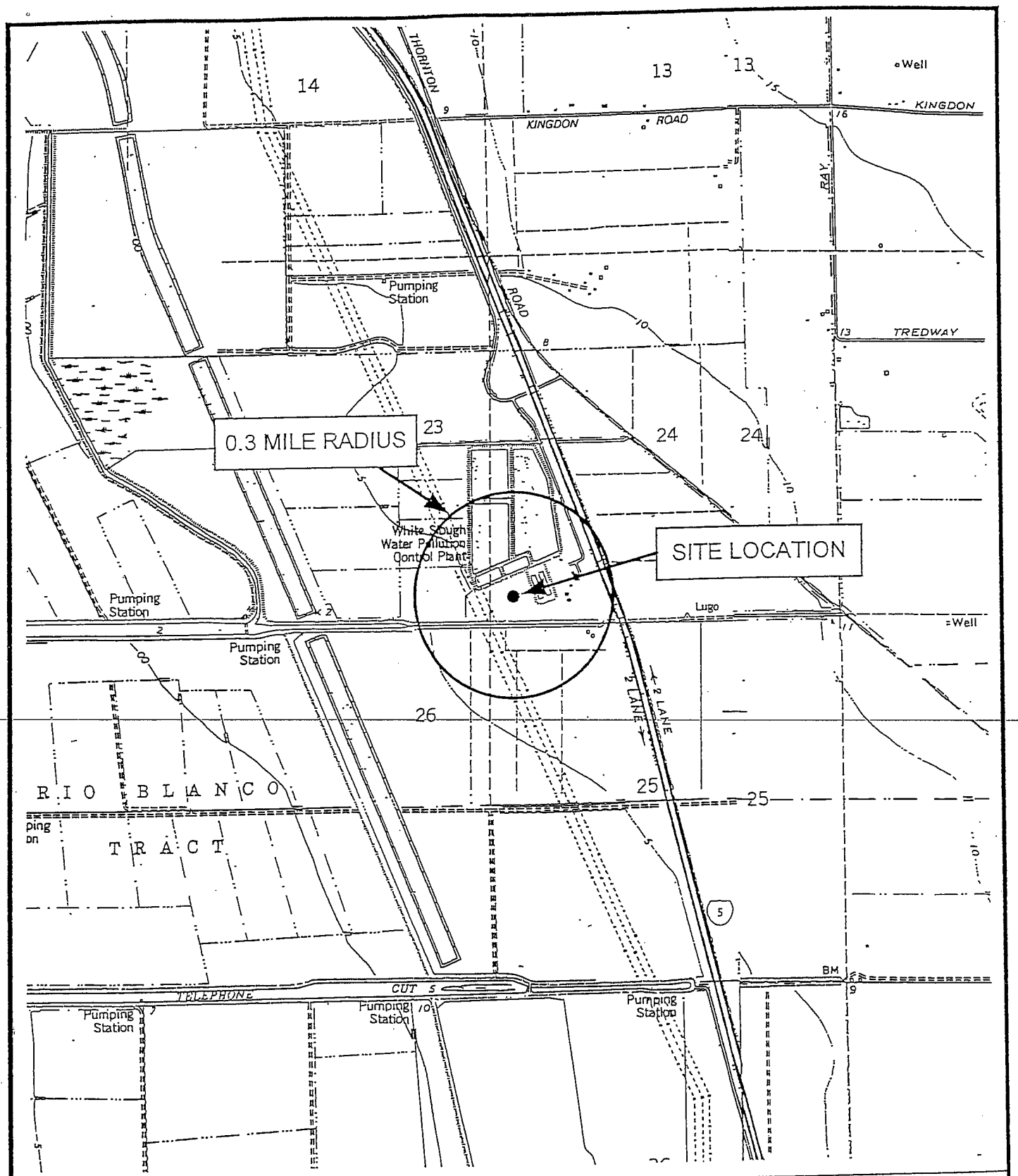
4 jet shots/ft. 0.31-in. holes.

120° phasing

4,234 - 4,239
4,244 - 4,254
4,267 - 4,288
4,296 - 4,306
4,312 - 4,326
4,331 - 4,379
4,390 - 4,411
4,432 - 4,507
4,528 - 4,538
4,565 - 4,573

Total net perforated interval = 222 ft

* Depths are based on HLS open hole logs dated 5/2/93 and 5/7/93, except as noted.



T3N / R5E

Ref: USGS Topographic maps - Thornton, Terminous, Lodi North, & Lodi South, California

0 1 Mile

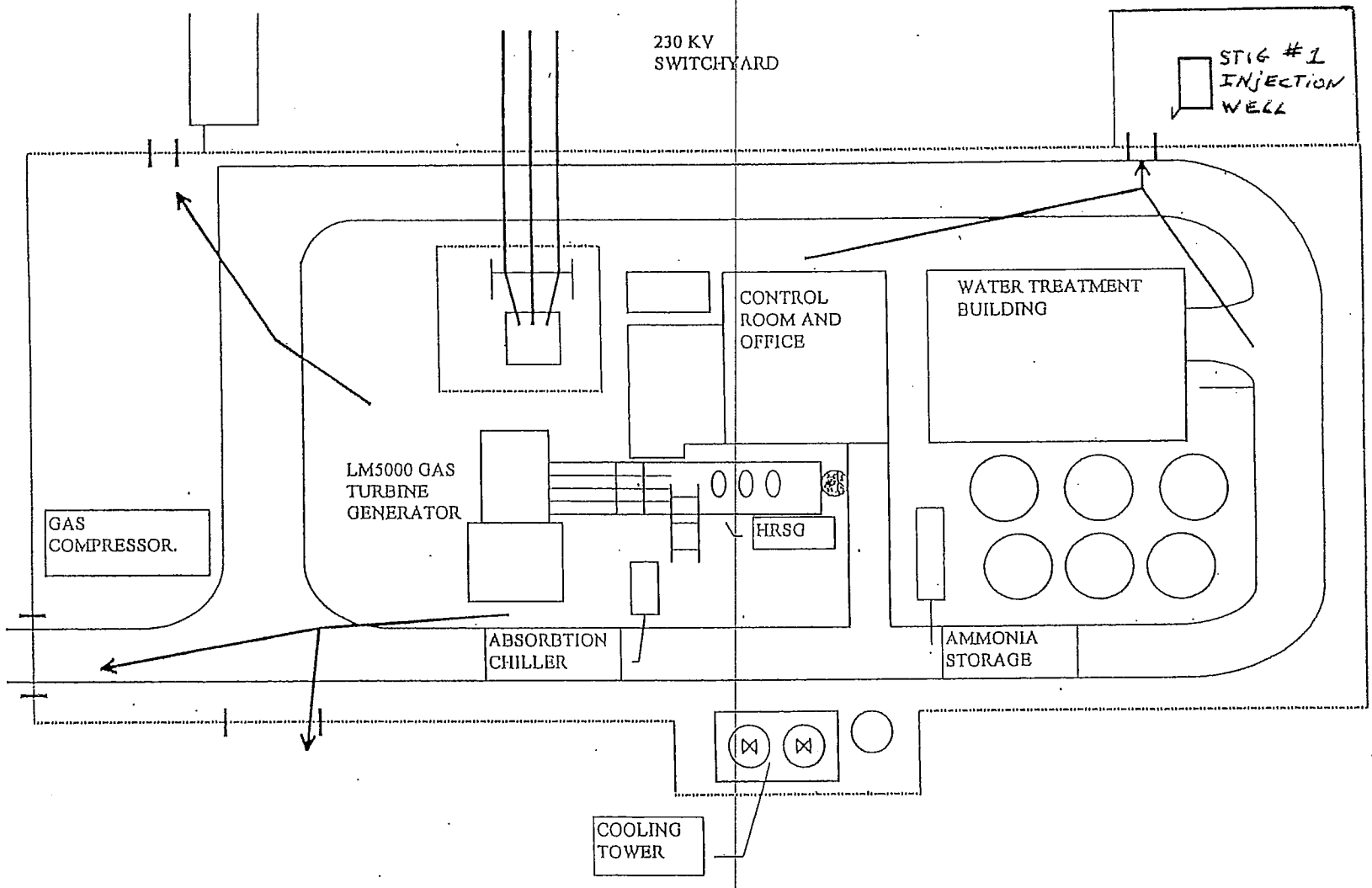
0 2000 Feet

8/99
1417.0011

WZI INC.
BAKERSFIELD, CALIFORNIA

NORTHERN CALIFORNIA POWER AGENCY

ALTERNATIVE RELEASE SCENARIO



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NOT TO SCALE

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WZI INC.
BAKERSFIELD, CALIFORNIA

NORTHERN CALIFORNIA
POWER AGENCY

EVACUATION ROUTE MAP

HALLIBURTON

Sales Quote

Quote Number:	*Quote Date:*	**Thursday, September 11, 2008**

Sold To #:
Toni Pezzetti
CH2M HILL
2485 Natomas Park Drive Suite 600
Sacramento CA 95833

Account Representative:	Mike Noel
Office Phone Number:	O 530.666.0233 / C 530.219.3652
Sales Office:	Woodland, CA, USA
Primary Service Center:	Woodland, CA, USA
Secondary Service Center:	
Proposal #:	CH2MHill_Lodi_091108

Ship To #:
Name: STIG #1
City: Lodi
County: San Joaquin
State: CA

Bill To #:

Material	Description	QTY	UOM	Base Amt	Unit Amt	Gross Amount	Discount	Net Amount
7528	CMT PLUG TO ABANDON BOM	1	JOB	0.00	0.00	0.00		0.00
16094	PLUG BACK/SPOT CEMENT OR MUD,ZI	1	EA	0.00	8,028.00	8,028.00		8,028.00
	DEPTH	4567						
	FEET/METERS (FT/M)		FT					
	Variants condition	0						
16096	PLUGGING BACK, EA ADD HR, ZI	1	EA	0.00	1,071.00	12,852.00		12,852.00
	HOURS	12						
8	IRON SAFETY INSPECTION SURCHARGE /JOB Z	1	JOB	0.00	83.00	83.00		83.00
139	ADC (AUTO DENSITY CTRL) SYS, /JOB,Z	1	JOB	0.00	2,275.00	2,275.00		2,275.00
	NUMBER OF UNITS	1						
452969	PLUGCEM (TM) SYSTEM	245	SK			13,016.85		13,016.85
100003653	CFR-3	116	LB	0.00	14.69	1,704.04		1,704.04
101299981	CALCIUM CHLORIDE, PELLET	5	LB	0.00	3.61	18.03		18.03
452969	PLUGCEM (TM) SYSTEM	38	SK			2,018.94		2,018.94
100003653	CFR-3	18	LB	0.00	14.69	264.42		264.42
101299981	CALCIUM CHLORIDE, PELLET	2	LB	0.00	3.61	7.21		7.21
2	MILEAGE FOR CEMENTING CREW,ZI	120	MI	0.00	5.76	691.20		691.20
	Number of Units	1						
86954	ZI FUEL SURCHG-CARS/PICKUPS<1 1/2TON	120	MI	0.00	0.24	28.80		28.80
	Number of Units	1						
1	ZI-MILEAGE FROM NEAREST HES BASE,/UNIT	120	MI	0.00	9.79	1,174.80		1,174.80
	Number of Units	1						
86955	ZI FUEL SURCHG-HEAVY TRKS >1 1/2 TON	120	MI	0.00	0.73	87.60		87.60
	Number of Units	1						
76400	ZI MILEAGE,CMT MTLS DEL/RET MIN	60	MI	0.00	3.35	2,534.61		2,534.61
	NUMBER OF TONS	12.61						
87605	ZI FUEL SURCHG-CMT & CMT ADDITIVES	60	MI	0.00	0.24	181.58		181.58
	NUMBER OF TONS	12.61						
3965	HANDLE&DUMP SVC CHRG, CMT&ADDITIVES,ZI	273	CF	0.00	5.49	1,498.77		1,498.77
	NUMBER OF EACH	1						
				Totals	*USD*	46,464.85	0.00	46,464.85

QUOTE TOTAL: USD 46,464.85

NORTHERN COMPANY POWER AGENCY

LEASE : LODI STIG

WELL NO.: 1

TEST NO.: 1

TICKET NO. 28635600
10-MAY-93
WOODLAND.

DST REPORT PRODUCED BY HRS
A DIVISION OF HALLIBURTON COMPANY

LODI STIG
LEASE NAME

1
WELL NO.

1
TEST NO.

3550.1 - 3677.0
TESTED INTERVAL

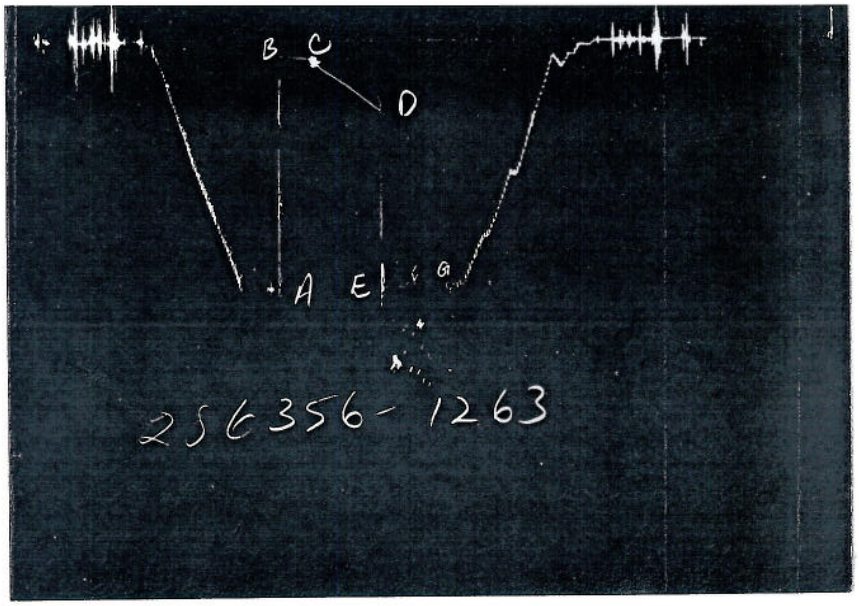
NORTHERN COMPANY POWER AGENCY
LEASE OWNER/COMPANY NAME

LEGAL LOCATION
SEC - TWP - RNG
24 - 3 N - 5 E

FIELD
AREA
WHITE SLOUGH

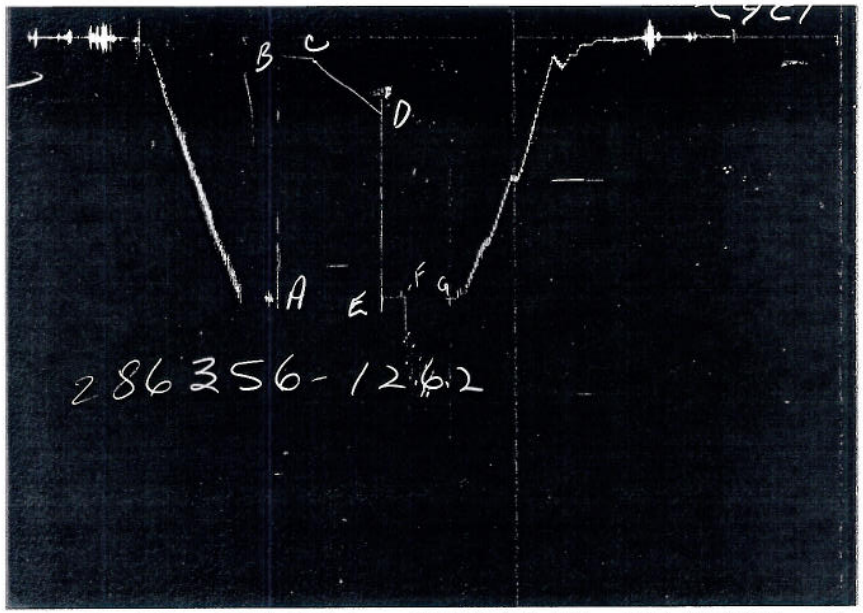
COUNTY
SAN JOAQUINE

STATE
CALIFORNIA



GAUGE NO: 1263 DEPTH: 3533.9 BLANKED OFF: NO HOUR OF CLOCK: 12

ID	DESCRIPTION	PRESSURE REPORTED	PRESSURE CALCULATED	TIME REPORTED	TIME CALCULATED	TYPE
A	INITIAL HYDROSTATIC	1679	1686.7			
B	INITIAL FIRST FLOW	93	249.5	30.0	29.9	F
C	FINAL FIRST FLOW	140	125.2			
C	INITIAL FIRST CLOSED-IN	140	125.2	60.0	60.1	C
D	FINAL FIRST CLOSED-IN	490	485.6			
E	FINAL HYDROSTATIC	1679	1684.1			
F	BEGIN LEAK-OFF TEST		1684.1		34.7	
G	END LEAK-OFF TEST		1694.5			



GAUGE NO: 1262 DEPTH: 3559.1 BLANKED OFF: YES HOUR OF CLOCK: 12

ID	DESCRIPTION	PRESSURE REPORTED	PRESSURE CALCULATED	TIME REPORTED	TIME CALCULATED	TYPE
A	INITIAL HYDROSTATIC	1689	1701.3			
B	INITIAL FIRST FLOW	112	262.2	30.0	29.9	F
C	FINAL FIRST FLOW	156	138.4			
C	INITIAL FIRST CLOSED-IN	156	138.4	60.0	60.1	C
D	FINAL FIRST CLOSED-IN	491	499.4			
E	FINAL HYDROSTATIC	1689	1698.0			
F	BEGIN LEAK-OFF TEST		1698.0		34.7	
G	END LEAK-OFF TEST		1705.6			

EQUIPMENT & HOLE DATA

FORMATION TESTED:
NET PAY (ft): 2.0 (7.875" OPEN HOLE)
GROSS TESTED FOOTAGE: 126.9 PACKER TO T.D.
ALL DEPTHS MEASURED FROM: K.B.
CASING PERFS. (ft):
HOLE OR CASING SIZE (in): 7.000
ELEVATION (ft): 37.0
TOTAL DEPTH (ft): 3677.0 (CASING TO 3675')
PACKER DEPTH(S) (ft): 3550
FINAL SURFACE CHOKE (in):
BOTTOM HOLE CHOKE (in): 0.375
MUD WEIGHT (lb/gal): 9.60
MUD VISCOSITY (sec): 34
ESTIMATED HOLE TEMP. (°F): 125
ACTUAL HOLE TEMP. (°F): ___ @ ___ ft

TICKET NUMBER: 286356.00
DATE: 05-05-93 TEST NO: 1
TYPE DST: CASED HOLE
FIELD CAMP: WOODLAND.
TESTER: ROBERT J. VALENTINE
WITNESS: DENNIS P. BROWN
DRILLING CONTRACTOR: PAUL GRAHAM DRILLING

FLUID PROPERTIES FOR RECOVERED MUD & WATER

SOURCE	RESISTIVITY	CHLORIDES
TOOLS	@ °F	800 ppm
TOP OF COLLARS	@ °F	550 ppm
	@ °F	ppm
	@ °F	ppm
	@ °F	ppm
	@ °F	ppm

SAMPLER DATA

Psig AT SURFACE:
cu.ft. OF GAS:
cc OF OIL:
cc OF WATER:
cc OF MUD:
TOTAL LIQUID cc:

HYDROCARBON PROPERTIES

OIL GRAVITY (°API): ___ @ ___ °F
GAS/OIL RATIO (cu.ft. per bbl):
GAS GRAVITY:

CUSHION DATA

TYPE	AMOUNT	WEIGHT

RECOVERED:

210 FT. OF MUD IN PIPE

MEASURED FROM TESTER VALVE

REMARKS:

NOTE: TESTING 2 FT. OF 7.875" OPEN HOLE BELOW 7" CASING WITH SHOE AT 3675 FT. AND T.D. OF HOLE AT 3677 FT.

TYPE & SIZE MEASURING DEVICE: _____ TICKET NO: 28635600

TIME	CHOKE SIZE	SURFACE PRESSURE PSI	GAS RATE MCF	LIQUID RATE BPD	REMARKS
05-04-93					
2030					ON LOCATION MAKING UP TOOLS
2035					LOADED GAUGES
2130					STARTED IN THE HOLE
2335					ON BOTTOM; HOOKED UP SURFACE
					EQUIPMENT
05-05-93					
0001					SET PACKER
0004					HYDROSPRING OPENED
0006		3			WEAK BLOW (CLOSED AT SURFACE)
0015	B.H.				DIMINISHED BLOW
0034					CLOSED TOOL
0134					PULLED TOOLS LOOSE
0153					STARTED LEAK-OFF TEST ON 7"
					CASING SHOE; PUMPING THROUGH
					ANNULUS
0154		200			NO LEAK-OFF
0155		325			LEAK-OFF
0158		410			LEAK-OFF
0205		510			BLED OFF TO 500 PSI; PRESSURED
					BACK UP TO 525 PSI; PRESSURE BLED
					OFF TO 475 PSI
0235					PULLED TOOLS OUT OF THE HOLE
0530					LAID DOWN TOOLS
0615					READ CHARTS
0700					LEFT LOCATION

TICKET NO: 28635600

CLOCK NO: 10163 HOUR: 12

GAUGE NO: 1263

DEPTH: 3533.9

REF	MINUTES	PRESSURE	ΔP	$\frac{t \times \Delta t}{t + \Delta t}$	$\log \frac{t + \Delta t}{\Delta t}$
		FIRST FLOW			
B 1	0.0	249.5			
2	1.0	125.7	-123.8		
3	2.0	107.5	-18.2		
4	3.0	107.5	0.0		
5	4.0	108.2	0.7		
6	5.0	109.8	1.6		
7	10.0	115.3	5.5		
8	15.0	119.0	3.7		
9	20.0	121.6	2.5		
10	25.0	123.9	2.3		
C 11	29.9	125.2	1.3		
		FIRST CLOSED-IN			
C 1	0.0	125.2			
2	5.0	176.9	51.8	4.3	0.845
3	10.0	210.5	85.4	7.5	0.602
4	15.0	234.8	109.6	10.0	0.475
5	20.0	257.9	132.7	12.0	0.387
6	25.0	284.7	159.6	13.6	0.342
7	30.0	310.7	185.5	15.0	0.301
8	35.0	339.1	213.9	16.1	0.268
9	40.0	367.9	242.7	17.1	0.242
10	45.0	400.8	275.6	18.0	0.221
11	50.0	430.9	305.7	18.7	0.204
12	55.0	459.2	334.0	19.4	0.189
D 13	60.1	485.6	360.4	20.0	0.175
		LEAK-OFF TEST			
F 1	0.0	1684.1			
[1] 2	0.5	1956.6			
[2] 3	1.3	1943.9			
[1] 4	1.6	2089.2			
[2] 5	5.4	2021.7			
[1] 6	5.5	2194.9			
[2] 7	12.4	2116.8			
[1] 8	12.4	2226.2			
[3] 9	17.1	2165.6			
[1] 10	17.1	2283.5			
[2] 11	20.8	2226.4			
[1] 12	20.8	2324.5			
[3] 13	34.7	2221.0			
G 14	34.7	1694.5			

REF	MINUTES	PRESSURE	ΔP	$\frac{t \times \Delta t}{t + \Delta t}$

LEGEND:
[1] STARTED BLEEDOFF [2] STARTED PUMPING [3] END OF BLEED-OFF

REMARKS:

TICKET NO: 28635600	
CLOCK NO: 23055	HOUR: 12

GAUGE NO: 1262	
DEPTH: 3559.1	

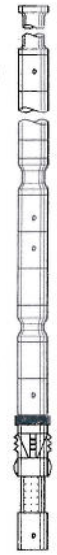
REF	MINUTES	PRESSURE	ΔP	$\frac{t \times \Delta t}{t + \Delta t}$	$\log \frac{t + \Delta t}{\Delta t}$
		FIRST FLOW			
B 1	0.0	262.2			
2	1.0	134.0	-128.2		
3	2.0	117.2	-16.8		
4	3.0	117.2	0.0		
5	4.0	118.2	1.0		
6	5.0	120.2	2.0		
7	10.0	126.6	6.3		
8	15.0	130.3	3.8		
9	20.0	133.2	2.9		
10	25.0	136.2	3.0		
C 11	29.9	138.4	2.2		
		FIRST CLOSED-IN			
C 1	0.0	138.4			
2	5.0	180.0	41.6	4.3	0.841
3	10.0	216.3	77.8	7.5	0.600
4	15.0	249.2	110.8	10.0	0.476
5	20.0	275.6	137.2	12.0	0.397
6	25.0	300.5	162.1	13.6	0.342
7	30.0	323.8	185.4	15.0	0.300
8	35.0	350.2	211.8	16.1	0.268
9	40.0	380.1	241.6	17.1	0.242
10	45.0	408.1	269.7	18.0	0.221
11	50.0	441.4	303.0	18.7	0.204
12	55.0	472.5	334.0	19.4	0.189
D 13	60.1	499.4	361.0	20.0	0.175
		LEAK-OFF TEST			
F 1	0.0	1898.0			
[1] 2	0.5	1970.4			
[2] 3	1.3	1954.2			
[1] 4	1.6	2102.4			
[2] 5	5.4	2033.6			
[1] 6	5.5	2208.4			
[2] 7	12.4	2128.1			
[1] 8	12.4	2236.4			
[2] 9	17.1	2175.7			
[1] 10	17.1	2294.5			
[2] 11	20.8	2239.9			
[1] 12	20.8	2335.4			
[3] 13	34.7	2232.2			
G 14	34.7	1705.6			

REF	MINUTES	PRESSURE	ΔP	$\frac{t \times \Delta t}{t + \Delta t}$	$\log \frac{t + \Delta t}{\Delta t}$

LEGEND:
[1] STARTED BLEEDOFF [2] STARTED PUMPING [3] END OF BLEED-OFF

REMARKS:

TICKET NO. 28635600



		O.D.	I.D.	LENGTH	DEPTH
1	DRILL PIPE	3.500	2.764	3448.4	
50	IMPACT REVERSING SUB	5.000	2.750	1.0	3448.9
3	DRILL COLLARS	6.000	2.250	67.6	
5	CROSSOVER	5.000	2.750	1.0	
11	HANDLING SUB & CHOKE ASSEMBLY	3.875	0.375	5.0	
61	INDEXING HYDROSPRING TESTER	3.875	0.750	6.2	3529.2
31	LOC BYPASS	3.875	0.500	2.2	
80	AP RUNNING CASE	3.875	3.000	5.0	3533.9
14	EXTENSION JOINT	3.875	0.750	4.0	
15	JAR	3.875	1.250	5.0	
56	RTTS CIRCULATING VALVE	5.000	1.900	2.5	3547.9
76	RTTS PACKER	5.510	1.900	4.2	3550.1
21	PERFORATED TAIL PIPE	3.875	2.990	5.0	
81	BLANKED-OFF RUNNING CASE	3.875		4.0	3559.1
	TOTAL DEPTH				3677.0

EQUIPMENT DATA

FINAL PRINT

HALLIBURTON LOGGING SERVICES, INC.

DUAL INDUCTION COMPENSATED DENSITY DUAL SPACED NEUTRON

2"=100'

COMPANY N.C.P.A.
WELL LODI STIG NO.1
FIELD LODI
COUNTY SAN JOAQUIN STATE CA

COMPANY N.C.P.A.
WELL LODI STIG NO.1
FIELD LODI
COUNTY SAN JOAQUIN STATE CA
API NO 04-077-20567
LOCATION
478 FEET NORTH AND
83 FEET EAST FROM
THE SOUTHWEST CORNER OF:
SECT 24 TWP 3N. RGE 5E.

OTHER SERVICES
NONE

PERMANENT DATUM G.L. ELEV. 6.0
LOG MEASURED FROM K.B. 14.0 FT.ABOVE PERM DATUM
DRILLING MEASURED FROM KELLY BUSHING

ELEV.: K.B. 20.0
D.F. ------
G.L. 6.0

DATE	05/02/93	05/07/93		
RUN NO.	ONE	TWO		
DEPTH-DRILLER	3675	4652		
DEPTH-LOGGER	3672	4642		
BTM. LOG INTER	3670	4640		
TOP LOG INTER	CASING	CASING		
CASING DRILLER	10.75@ 614	7.00 @ 3674	@	@
CASING-LOGGER	611	3660		
BIT SIZE	9.875	6.250		
TYPE FLUID IN HOLE	CYPAN	CYPAN		
DENS. : VISC.	9.7 : 36	9.6 : 43	:	:
PH : FLUID LOSS	8.6 : 7.0	10.0 : 5.0	:	:
SOURCE OF SAMPLE	CIRCULATED	CIRCULATED		
RM @ MEAS. TEMP.	2.4 @ 90	2.0 @ 80	@	@
RMF @ MEAS. TEMP.	2.2 @ 80	1.8 @ 80	@	@
RMC @ MEAS. TEMP.	3.0 @ 80	2.2 @ 80	@	@
SOURCE RMF:RMC	MEAS :MEAS	MEAS.:MEAS.	:	:
RM @BHT	1.6 @ 130	1.2 @ 140	@	@
TIME SINCE CIRC.	17:00 05/02	08:00 05/07		
TIME ON BOTTOM	20:00 05/02	12:52 05/07		
MAX. REC TEMP.	130 @ BHT	140 @ BHT	@	@
EQUIP.: LOCATION	7626 :WDLND	7626 :WDLND	:	:
RECORDED BY	M.SCHWARTZ	M.SCHWARTZ		
WITNESSED BY	B.SMITH	D.BROWN		

FOLD HERE

SERVICE TICKET NO.: 95902 API SERIAL NO.: 04-077-20567 PGM VERSION: 2.30

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLES

DATE:SAMPLE NO.	05/02/93:ONE	05/07/93:TWO	TYPE LOG	DEPTH	SCALE UP HOLE	SCALE DOWN HOLE
DEPTH-DRILLER	SAME	SAME				
TYPE FLUID IN HOLE	AS ABOVE	AS ABOVE				
DENS. : VISC	: :	: :				
PH : FLUID LOSS						

RESISTIVITY SCALE CHANGES

RESISTIVITY EQUIPMENT DATA

SOURCE OF SAMPLE	RUN NO	TOOL TYPE & NO	PAD TYPE	TOOL POS.	OTHER
RM @ MEAS TEMP	@				
RMF @ MEAS TEMP	@				
RMC @ MEAS TEMP	@	DILT #W109432	N.A.	1.5"SO	W
SOURCE: RMF:RMC	:	DSGT #W108932	N.A.	1.5"SO	W
RM @ BHT	1.6 @ 130	1.2 @ 140			
RMF @ BHT	1.3 @ 130	1.1 @ 140			
RMC @ BHT	1.8 @ 130	1.3 @ 140			

EQUIPMENT DATA

GAMMA

RUN NO.	1&2	1&2
SERIAL NO.	W108581	SERIAL NO.
MODEL NO.	W 432	MODEL NO.
DIAMETER	3.625"	NO.OF CENT.
DETECTOR MODEL NO.	N.A.	SPACING
TYPE	SCINT.	4"
LENGTH		LSA [Y/N]
DISTANCE TO SOURCE	N.A.	FWDA [Y,N]

ACOUSTIC

RUN NO.	1&2	1&2
SERIAL NO.		SERIAL NO.
MODEL NO.		MODEL NO.
DIAMETER.		4.5"
LOG TYPE		GAMMA
SOURCE TYPE		CS137
SERIAL NO.		SDL047
STRENGTH		1.5 CI

DENSITY

NEUTRON

RUN NO.	1&2	1&2
SERIAL NO.	109732	108751
MODEL NO.	W 465	W 434
DIAMETER	4.5"	3.625"
LOG TYPE	GAMMA	NEUTRON
SOURCE TYPE	CS137	AM241BE
SERIAL NO.	SDL047	DSN25
STRENGTH	1.5 CI	1B.5 CI

LOGGING DATA

GENERAL

RUN NO	DEPTH FROM	DEPTH TO	SPEED FT/MIN
ONE	3672	611	40
TWO	4642	3660	40

GAMMA SCALE

L	R	
0	150	GAPI
"	"	

ACOUSTIC SCALE

L	R	MATRIX

DENSITY SCALE

L	R	MATRIX
1.65	2.65	2.65
"	"	GM/CC

NEUTRON SCALE

L	R	MATRIX
60%	0%	SAND
"	"	"

REMARKS: ANNULAR HOLE VOLUME CALCULATED FOR 5.0" CASING.

CREW ON LOCATION: M.EMERSON, J.PORTMAN. RIG: PAUL GRAHAM #2

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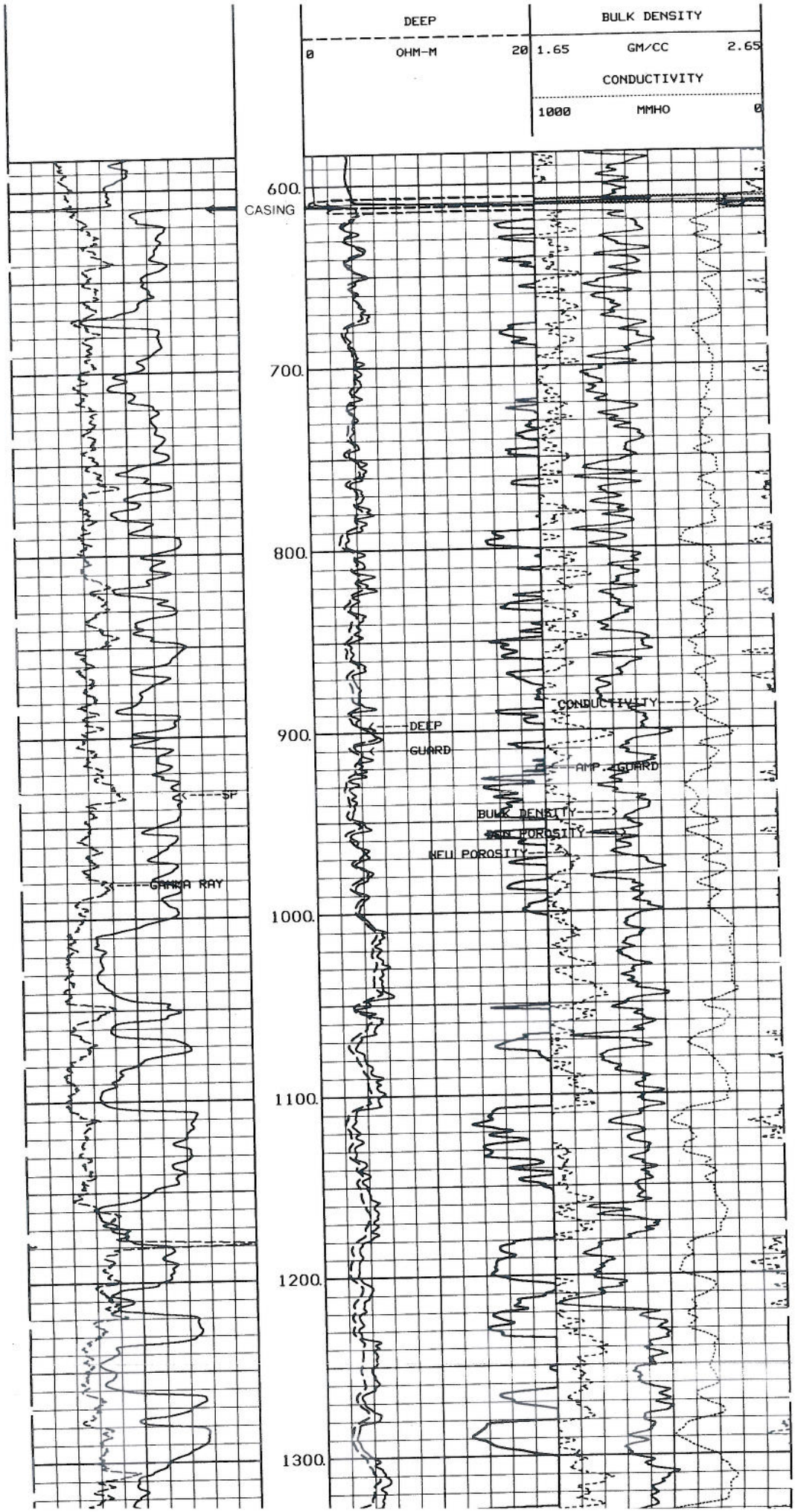
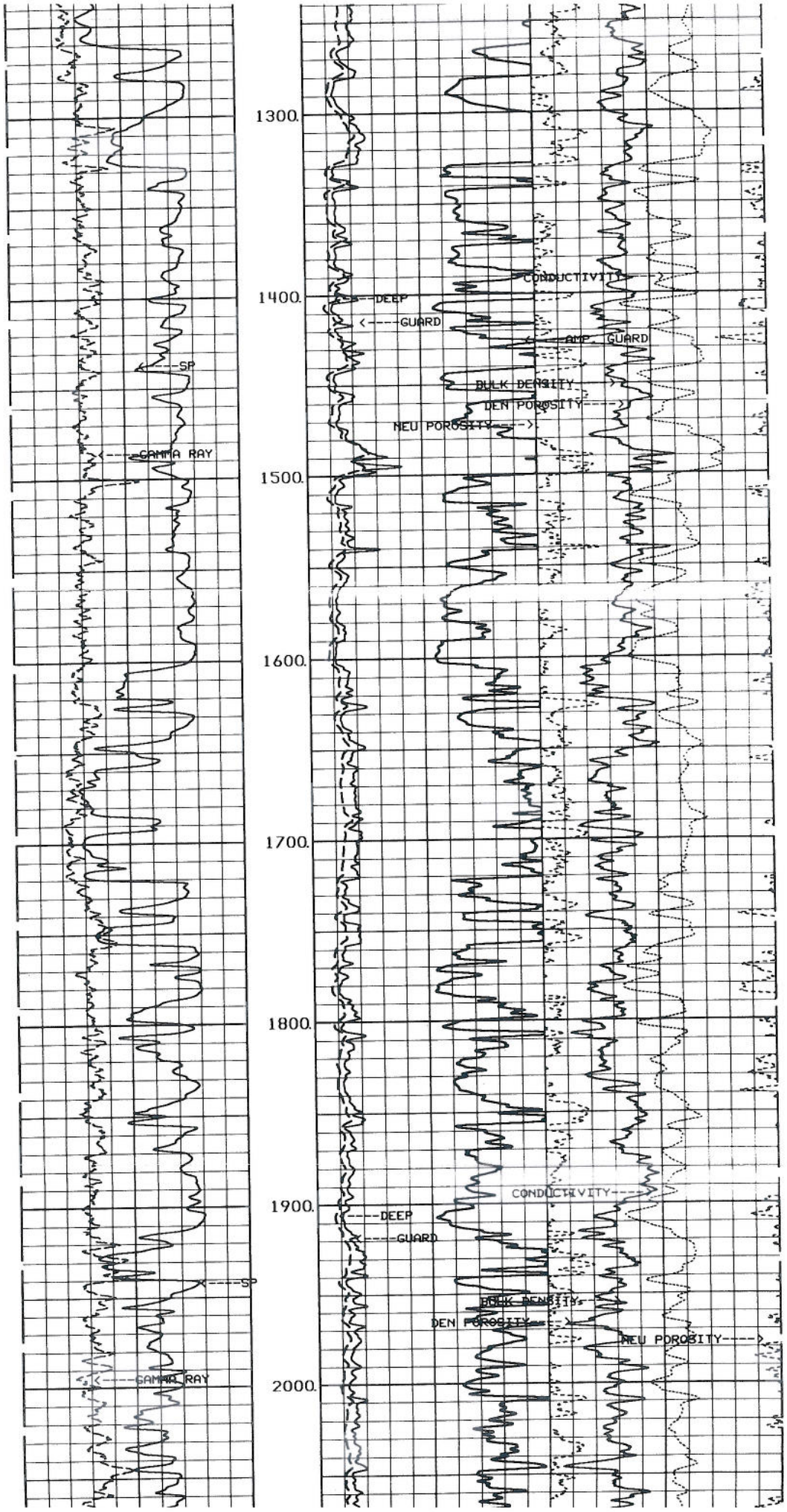
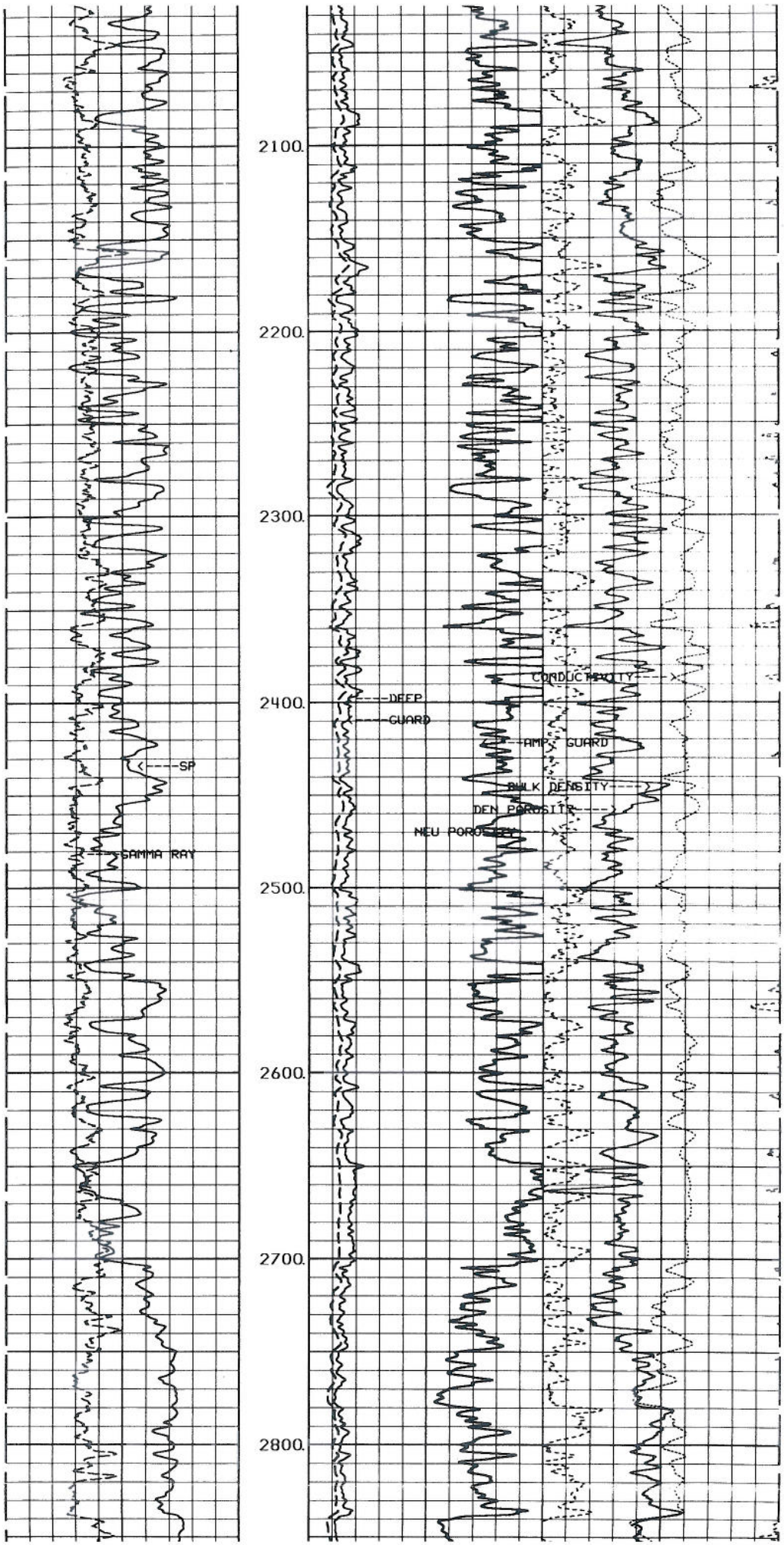
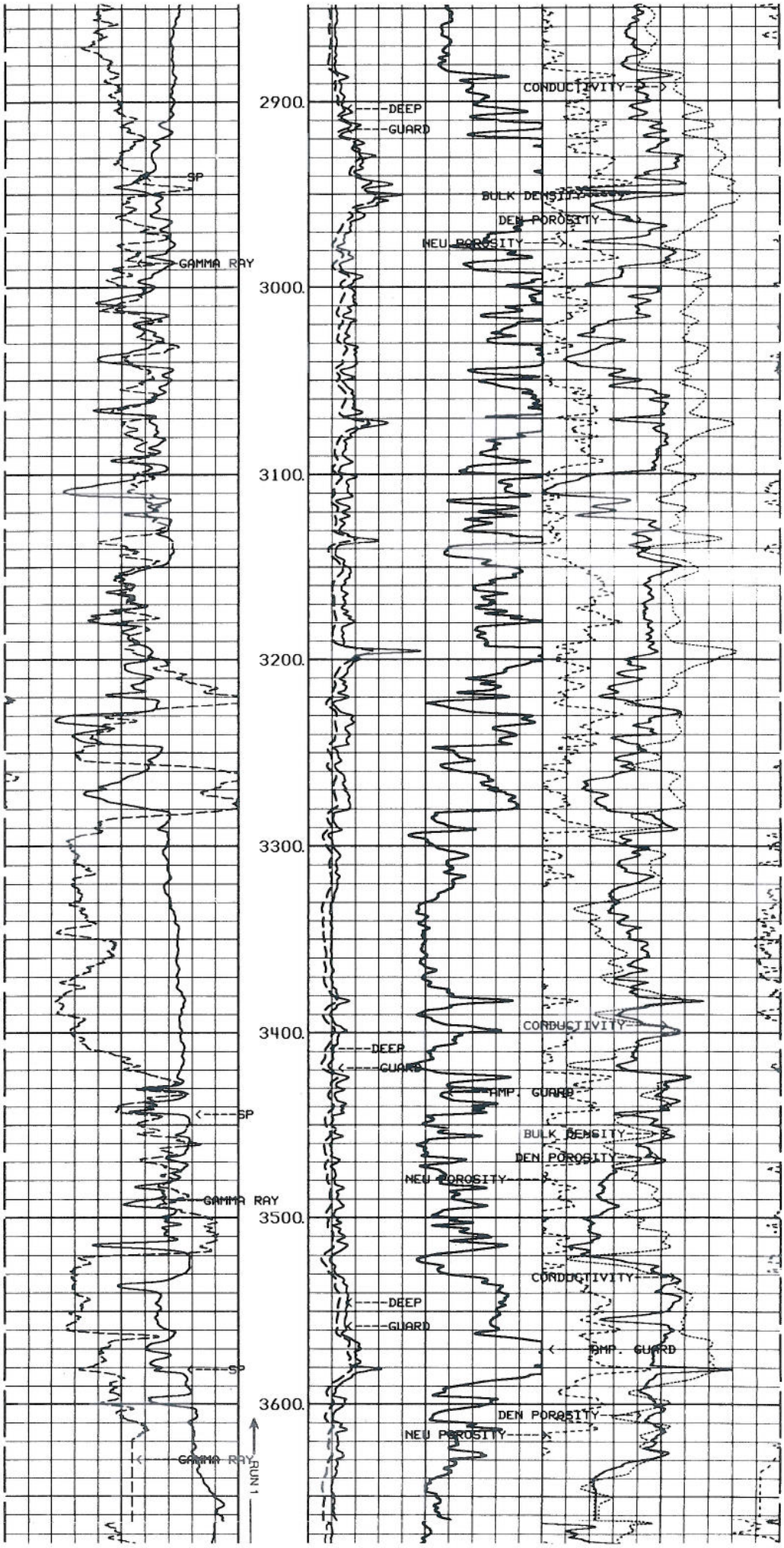
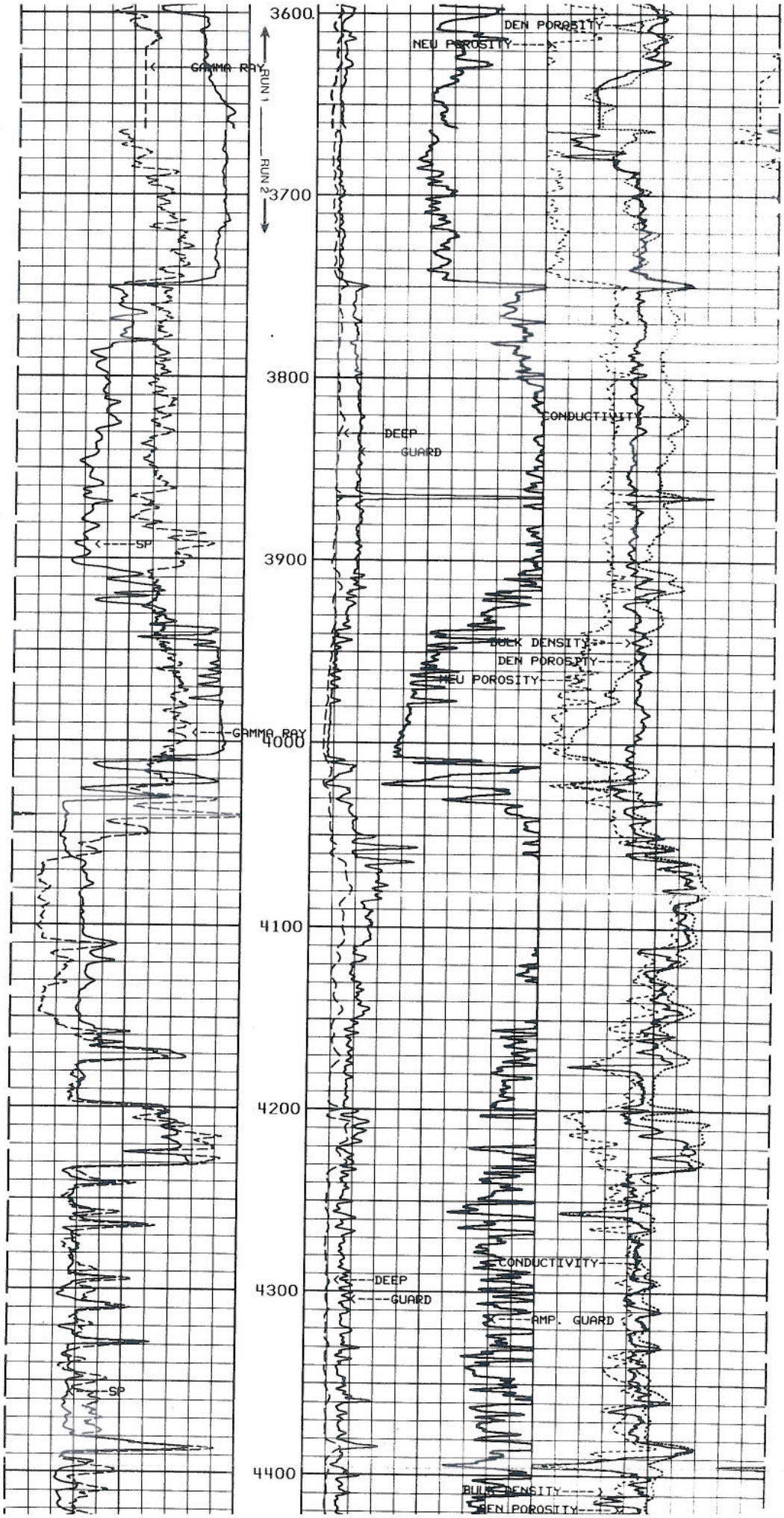
GAMMA RAY	AMP. GUARD	NEU POROSITY
0 API COUNTS 150	0 OHM-M 4	60 PERCENT 0
SP	GUARD	NEUTRON MATRIX = SAND
-110[+	0 OHM-M 20	60 PERCENT 0
		DEN POROSITY
		MATRIX DENSITY = 2.65

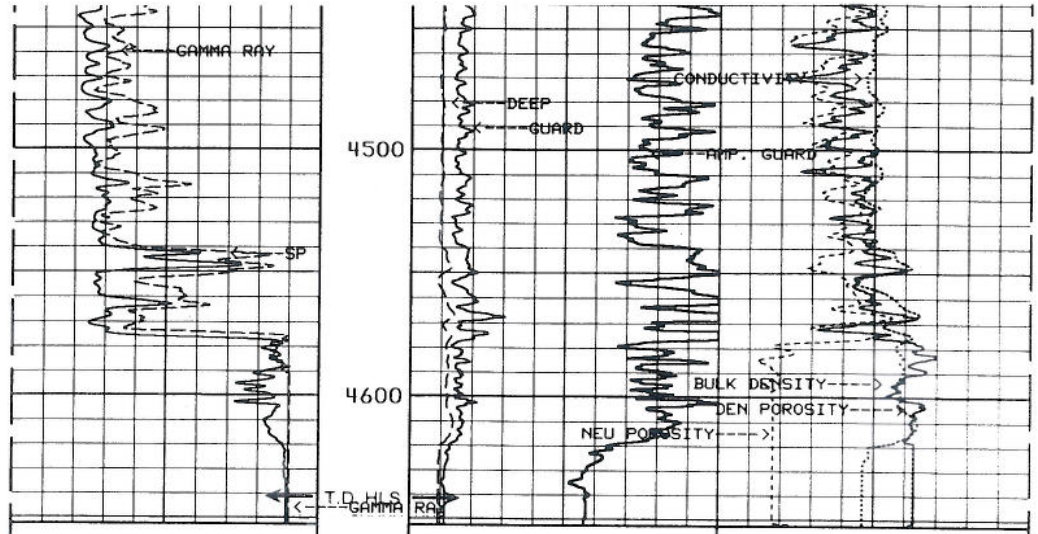

DEEP
0
OHM-M
20
BULK DENSITY
1.65
GM/CC
2.65
CONDUCTIVITY
1000
MMHO
0
600.
CASING
700.
800.
900.
1000.
1100.
1200.
1300.
CONDUCTIVITY
DEEP
GUARD
AMP. GUARD
SP
BULK DENSITY
GAMMA RAY
NFU POROSITY


1300.
1400.
1500.
1600.
1700.
1800.
1900.
2000.
CONDUCTIVITY
DEEP
GUARD
AMP. GUARD
BULK DENSITY
DEN POROSITY
NEU POROSITY
SP
GAMMA RAY
CONDUCTIVITY
DEEP
GUARD
BULK DENSITY
DEN POROSITY
NEU POROSITY
SP
GAMMA RAY


SP
GAMMA RAY
2100.
2200.
2300.
2400.
2500.
2600.
2700.
2800.
DEEP
GUARD
CONDUCTIVITY
AMP. GUARD
BULK DENSITY
DEN POROSITY
NEU POROSITY


2900.
3000.
3100.
3200.
3300.
3400.
3500.
3600.
SP
GAMMA RAY
DEEP
GUARD
CONDUCTIVITY
BULK DENSITY
DEN POROSITY
NEU POROSITY
AMP. GUARD
RUN 1


3600
3700
3800
3900
4000
4100
4200
4300
4400
RUN 1
RUN 2
GAMMA RAY
SP
GAMMA RAY
SP
DEN POROSITY
NEU POROSITY
CONDUCTIVITY
DEEP
GUARD
BULK DENSITY
DEN POROSITY
NEU POROSITY
CONDUCTIVITY
DEEP
GUARD
AMP. GUARD
BULK DENSITY
DEN POROSITY

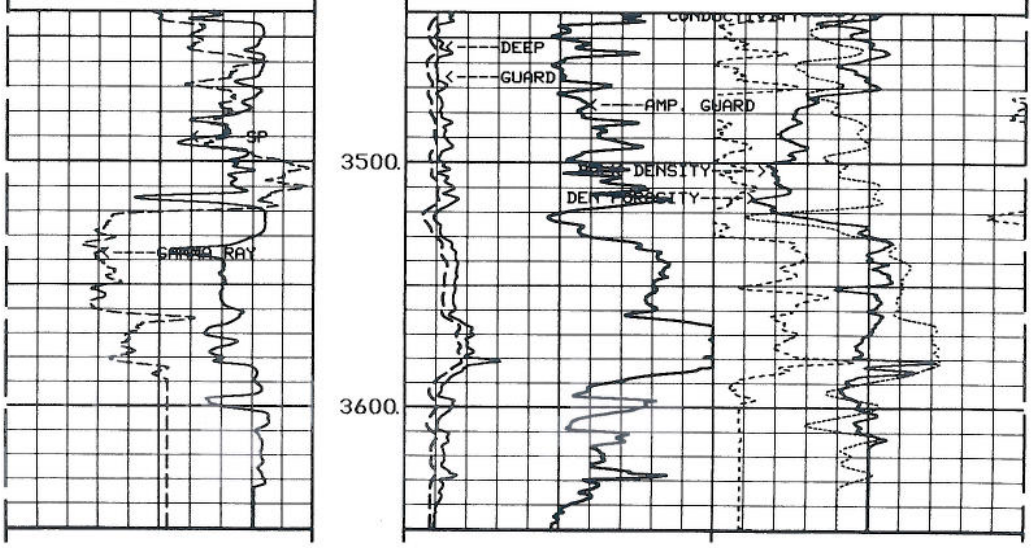


		CONDUCTIVITY
		1000 MMHO 0
	DEEP	BULK DENSITY
SP	0 OHM-M 20	1.65 GM/CC 2.65
	GUARD	DEN POROSITY
-]10[+	0 OHM-M 20	60 PERCENT 0
		MATRIX DENSITY = 2.65
GAMMA RAY	AMP. GUARD	NEU POROSITY
0 API COUNTS 150	0 OHM-M 4	60 PERCENT 0
		NEUTRON MATRIX = SAND

UPLOG # 2 Depth: 4660.00 Service:2100.02 Unit:7626
Realtime Log Date: 7-MAY-1993 Time: 12:50:56 Vers:2.30

RUN 1. REPEAT SECTION

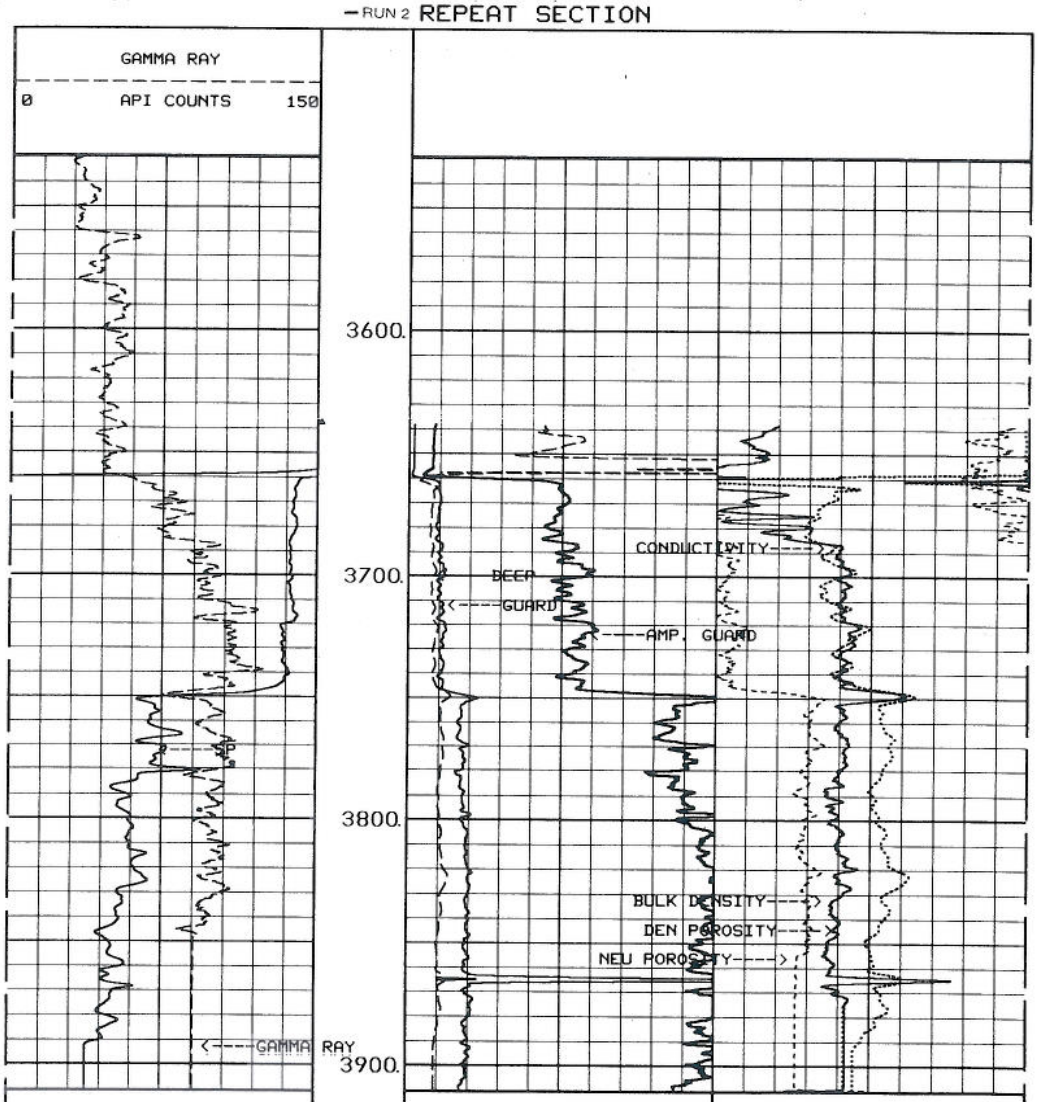
GAMMA RAY	AMP. GUARD	NEU POROSITY
0 API COUNTS 150	0 OHM-M 4	60 PERCENT 0
		NEUTRON MATRIX = SAND
SP	GUARD	DEN POROSITY
-]10[+	0 OHM-M 20	60 PERCENT 0
		MATRIX DENSITY = 2.65
	DEEP	BULK DENSITY
	0 OHM-M 20	1.65 GM/CC 2.65
		CONDUCTIVITY
		1000 MMHO 0



	DEEP	BULK DENSITY
	0 OHM-M 20	1.65 GM/CC 2.65
SP	GUARD	DEN POROSITY
-]10[+	0 OHM-M 20	60 PERCENT 0
		MATRIX DENSITY = 2.65
GAMMA RAY	AMP. GUARD	NEU POROSITY
0 API COUNTS 150	0 OHM-M 4	60 PERCENT 0
		NEUTRON MATRIX = SAND

UPLOG # 2 Depth: 3650.00 Service:2100.02 Unit:7626
Replay Log Date: 2-MAY-1993 Time: 20:08:43 Vers:2.30

—RUN 2 REPEAT SECTION



		CONDUCTIVITY
		1000 MMHO 0
	DEEP	BULK DENSITY
	0 OHM-M 20	1.65 GM/CC 2.65
SP	GUARD	DEN POROSITY
-]10[+	0 OHM-M 20	60 PERCENT 0
		MATRIX DENSITY = 2.65
GAMMA RAY	AMP. GUARD	NEU POROSITY
0 API COUNTS 150	0 OHM-M 4	60 PERCENT 0
		NEUTRON MATRIX = SAND

UPLOG # 1 Depth: 3910.00 Service:2100. Unit:7626
Replay Log Date: 7-MAY-1993 Time: 12:28:02 Vers:2.30

FINAL PRINT

HALLIBURTON LOGGING SERVICES, INC.

DUAL INDUCTION COMPENSATED DENSITY DUAL SPACED NEUTRON

5"=100'

COMPANY N.C.P.A.
WELL LODI STIG NO.1
FIELD LODI
COUNTY SAN JOAQUI STATE CA

COMPANY N.C.P.A.
WELL LODI STIG NO.1
FIELD LODI
COUNTY SAN JOAQUIN STATE CA
API NO 04-077-20567
LOCATION
478 FEET NORTH AND
83 FEET EAST FROM
THE SOUTHWEST CORNER OF:
SECT 24 TWP 3N. RGE 5E.

OTHER SERVICES
NONE

PERMANENT DATUM G.L. ELEV. 6.0
LOG MEASURED FROM K.B. 14.0 FT.ABOVE PERM DATUM
DRILLING MEASURED FROM KELLY BUSHING

ELEV.: K.B. 20.0
D.F. ------
G.L. 6.0

DATE	05/02/93	05/07/93		
RUN NO.	ONE	TWO		
DEPTH-DRILLER	3675	4652		
DEPTH-LOGGER	3672	4642		
BTM. LOG INTER	3670	4640		
TOP LOG INTER	CASING	CASING		
CASING DRILLER	10.75@ 614	7.00 @ 3674	@	@
CASING-LOGGER	611	3660		
BIT SIZE	9.875	6.250		
TYPE FLUID IN HOLE	CYPAN	CYPAN		
DENS. : VISC.	9.7 : 36	9.6 : 43	:	:
PH : FLUID LOSS	8.6 : 7.0	10.0 : 5.0	:	:
SOURCE OF SAMPLE	CIRCULATED	CIRCULATED		
RM @ MEAS. TEMP.	2.4 @ 90	2.0 @ 80	@	@
RMF @ MEAS. TEMP.	2.2 @ 80	1.8 @ 80	@	@
RMC @ MEAS. TEMP.	3.0 @ 80	2.2 @ 80	@	@
SOURCE RMF:RMC	MEAS :MEAS	MEAS.:MEAS.	:	:
RM @BHT	1.6 @ 130	1.2 @ 140	@	@
TIME SINCE CIRC.	17:00 05/02	08:00 05/07		
TIME ON BOTTOM	20:00 05/02	12:52 05/07		
MAX. REC TEMP.	130 @ BHT	140 @ BHT	@	@
EQUIP.: LOCATION	7626 :WDLND	7626 :WDLND	:	:
RECORDED BY	M.SCHWARTZ	M.SCHWARTZ		
WITNESSED BY	B.SMITH	D.BROWN		

FOLD HERE

SERVICE TICKET NO.: 95902 API SERIAL NO.: 04-077-20567 PGM VERSION: 2.30

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLES

DATE:SAMPLE NO.	05/02/93:ONE	05/07/93:TWO
DEPTH-DRILLER	SAME	SAME
TYPE FLUID IN HOLE	AS ABOVE	AS ABOVE
DENS. : VISC	:	:
PH : FLUID LOSS	:	:
SOURCE OF SAMPLE	@	@
RM @ MEAS TEMP	@	@
RMF @ MEAS TEMP	@	@
RMC @ MEAS TEMP	@	@
SOURCE: RMF:RMC	:	:
RM @ BHT	1.6 @ 130	1.2 @ 140
RMF @ BHT	1.3 @ 130	1.1 @ 140
RMC @ BHT	1.8 @ 130	1.3 @ 140

RESISTIVITY SCALE CHANGES

TYPE LOG	DEPTH	SCALE UP HOLE	SCALE DOWN HOLE

RESISTIVITY EQUIPMENT DATA

RUN NO	TOOL TYPE & NO	PAD TYPE	TOOL POS.	OTHER
DILT	#W109432	N.A.	1.5"SO	W
DSGT	#W108932	N.A.	1.5"SO	W

EQUIPMENT DATA

GAMMA		ACOUSTIC		DENSITY		NEUTRON	
RUN NO.	1&2	RUN NO.		RUN NO.	1&2	RUN NO.	1&2
SERIAL NO.	W108581	SERIAL NO.		SERIAL NO.	109732	SERIAL NO.	108751
MODEL NO.	W 432	MODEL NO.		MODEL NO.	W 465	MODEL NO.	W 434
DIAMETER	3.625"	NO.OF CENT.		DIAMETER.	4.5"	DIAMETER	3.625"
DETECTOR MODEL NO.	N.A.	SPACING		LOG TYPE	GAMMA	LOG TYPE	NEUTRON
TYPE	SCINT.			SOURCE TYPE	CS137	SOURCE TYPE	AM241BE
LENGTH	4"	LSA [Y/N]		SERIAL NO.	SDL047	SERIAL NO.	DSN25
DISTANCE TO SOURCE	N.A.	FWDA [Y,N]		STRENGTH	1.5 CI	STRENGTH	18.5 CI

LOGGING DATA

GENERAL			GAMMA		ACOUSTIC		DENSITY		NEUTRON		
RUN	DEPTH		SPEED	SCALE		SCALE		SCALE		SCALE	
NO	FROM	TO	FT/MIN	L R	L R	MATRIX	L R	MATRIX	L R	MATRIX	
ONE	3672	611	40	0 150	GAPI		1.65 2.65	2.65	60% 0%	SAND	
TWO	4642	3660	40	"			"	GM/CC	" "		

REMARKS: ANNULAR HOLE VOLUME CALCULATED FOR 5.0" CASING.

CREW ON LOCATION: M.EMERSON, J.PORTMAN. RIG: PAUL GRAHAM #2

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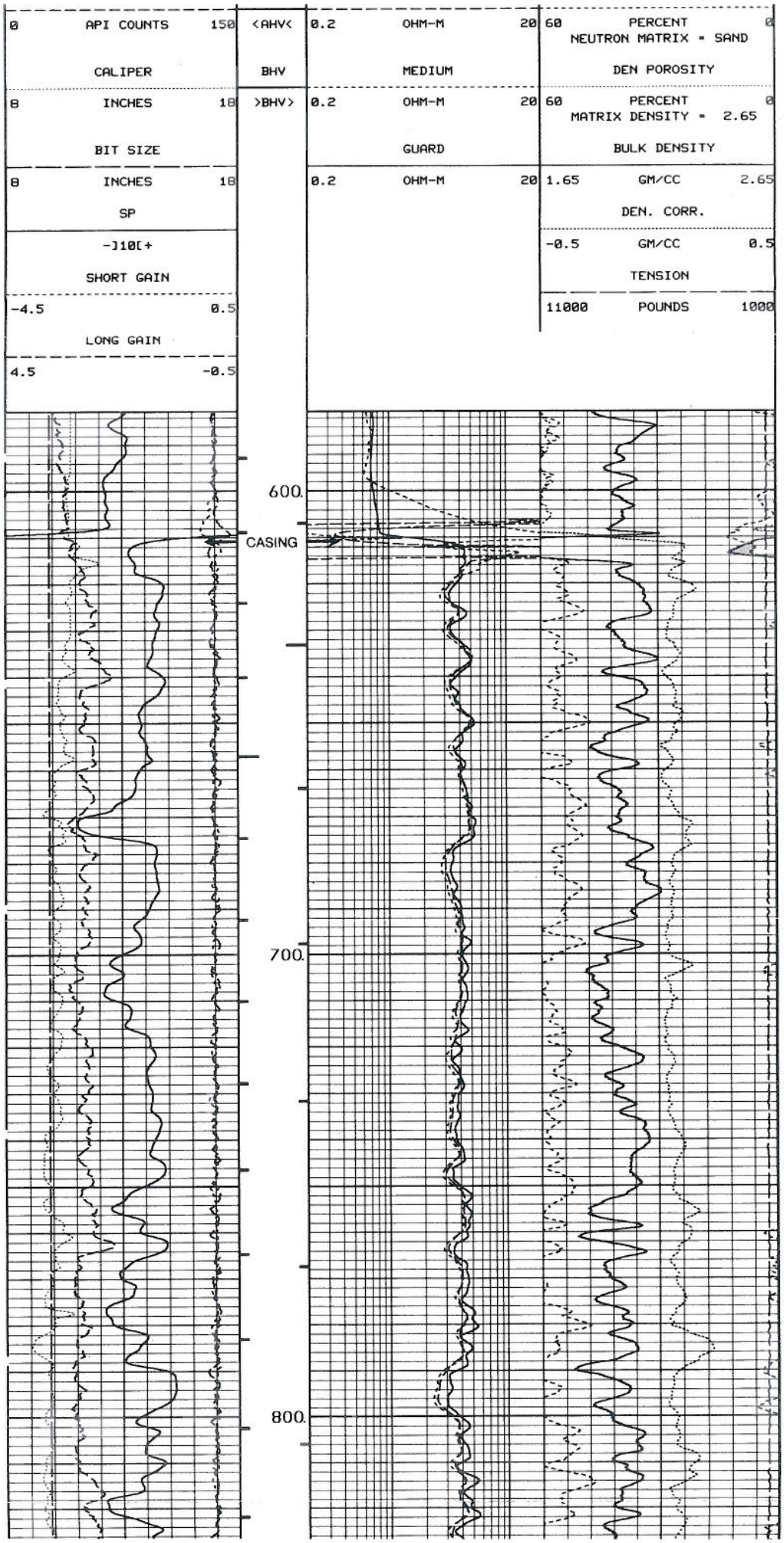
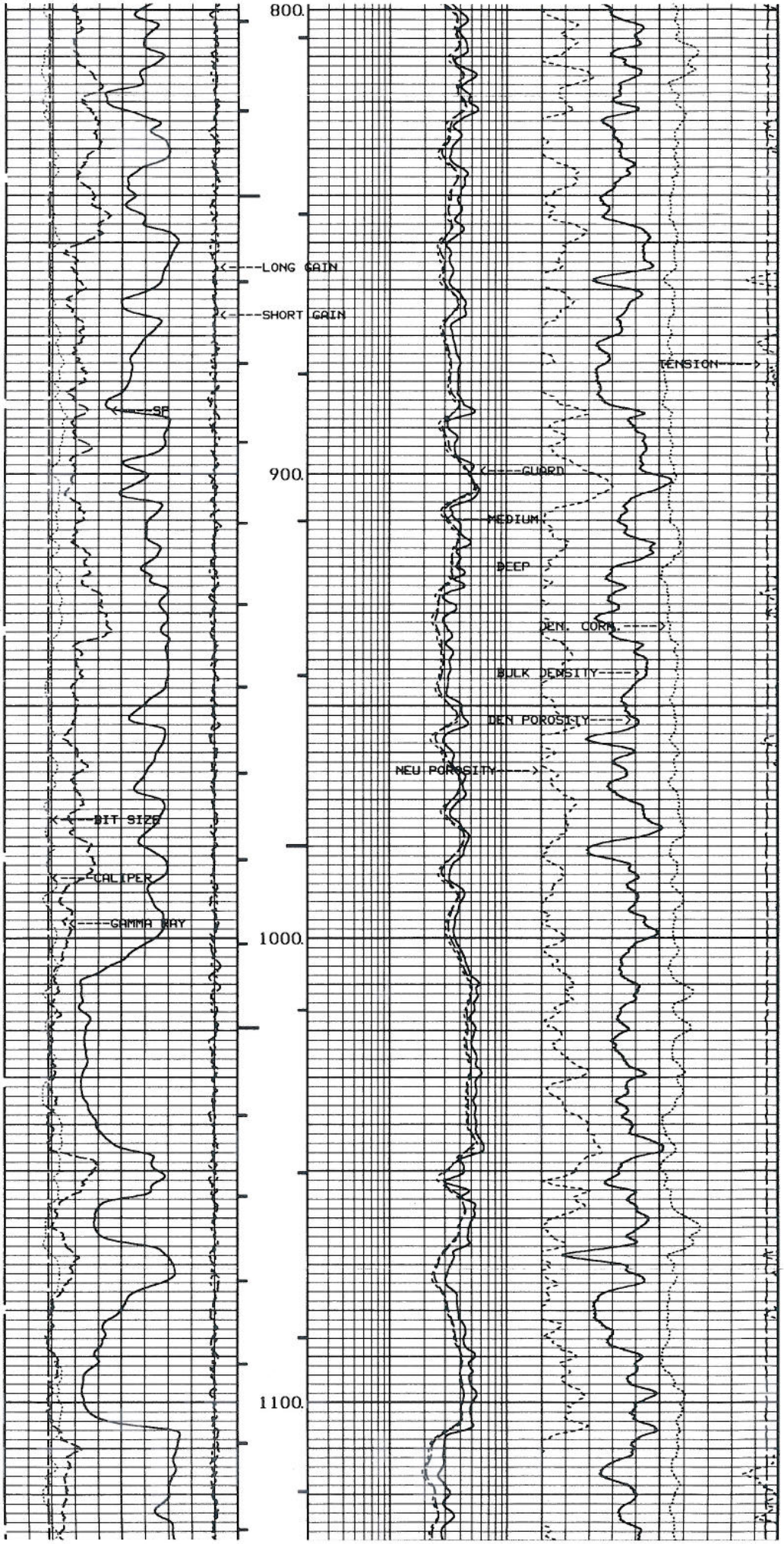
GAMMA RAY		AHV	DEEP			NEU POROSITY	
0 API COUNTS 150		<AHV<	0.2 OHM-M 20	60	PERCENT NEUTRON MATRIX = SAND		0
CALIPER		BHV	MEDIUM			DEN POROSITY	


0 API COUNTS 150
CALIPER
8 INCHES 18
BIT SIZE
8 INCHES 18
SP
-]10[+
SHORT GAIN
-4.5 0.5
LONG GAIN
4.5 -0.5
<AHV<
BHV
>BHV>
0.2 OHM-M 20
MEDIUM
0.2 OHM-M 20
GUARD
0.2 OHM-M 20
60 PERCENT 0
NEUTRON MATRIX = SAND
DEN POROSITY
60 PERCENT 0
MATRIX DENSITY = 2.65
BULK DENSITY
1.65 GM/CC 2.65
DEN. CORR.
-0.5 GM/CC 0.5
TENSION
11000 POUNDS 1000
600.
CASING
700.
800.


800.
900.
1000.
1100.
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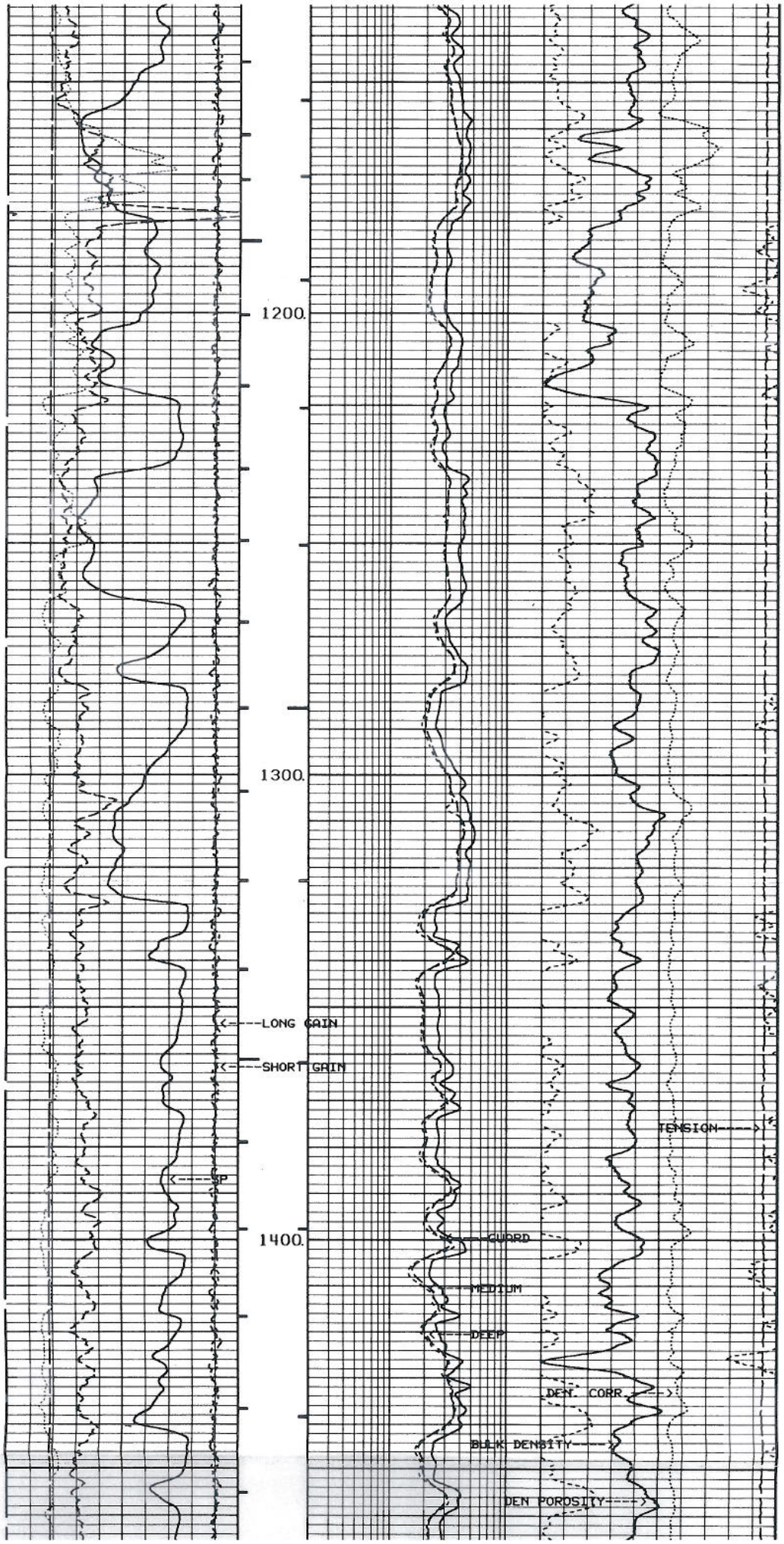
<----SHORT GAIN
<----SP
<----BIT SIZE
<----CALIPER
<----GAMMA RAY
TENSION---->
<----GUARD
MEDIUM
DEEP
DEN. CORR.---->
BULK DENSITY---->
DEN POROSITY---->
NEU POROSITY--->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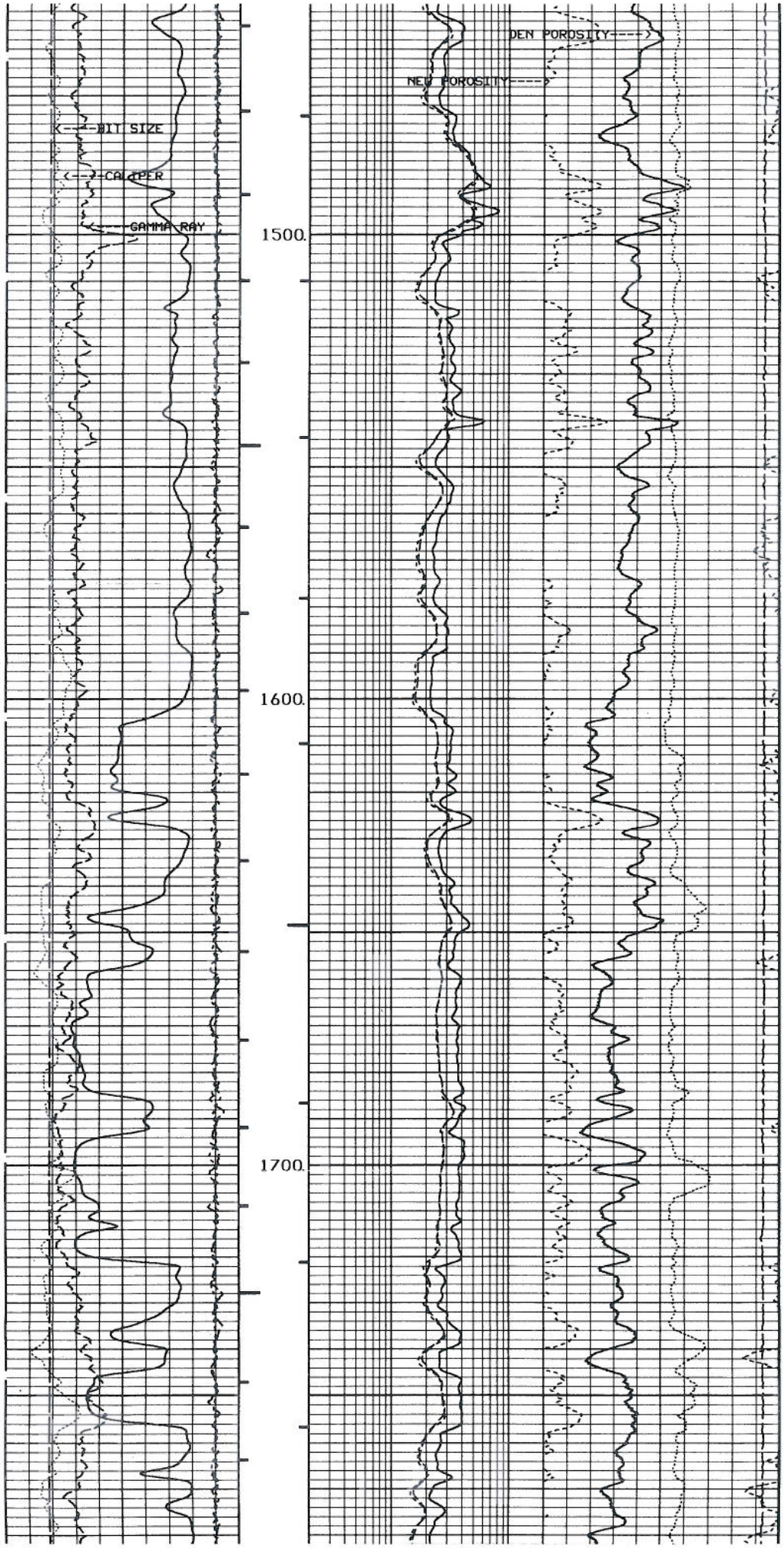
<----SP
TENSION---->
GUARD
MEDIUM
DEEP
DEN. CORR.---->
BULK DENSITY---->
DEN POROSITY--->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CALIPER
GAMMA RAY
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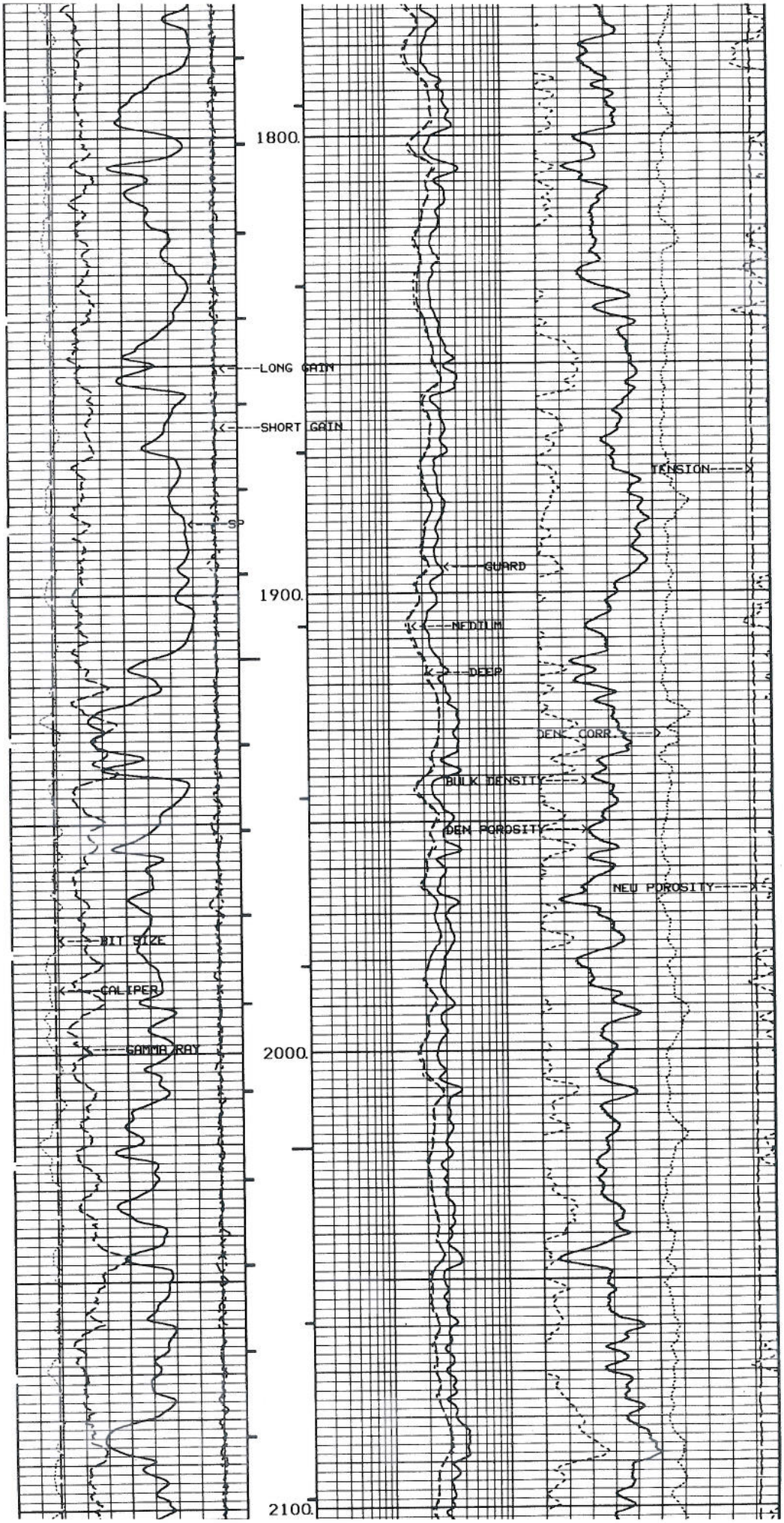
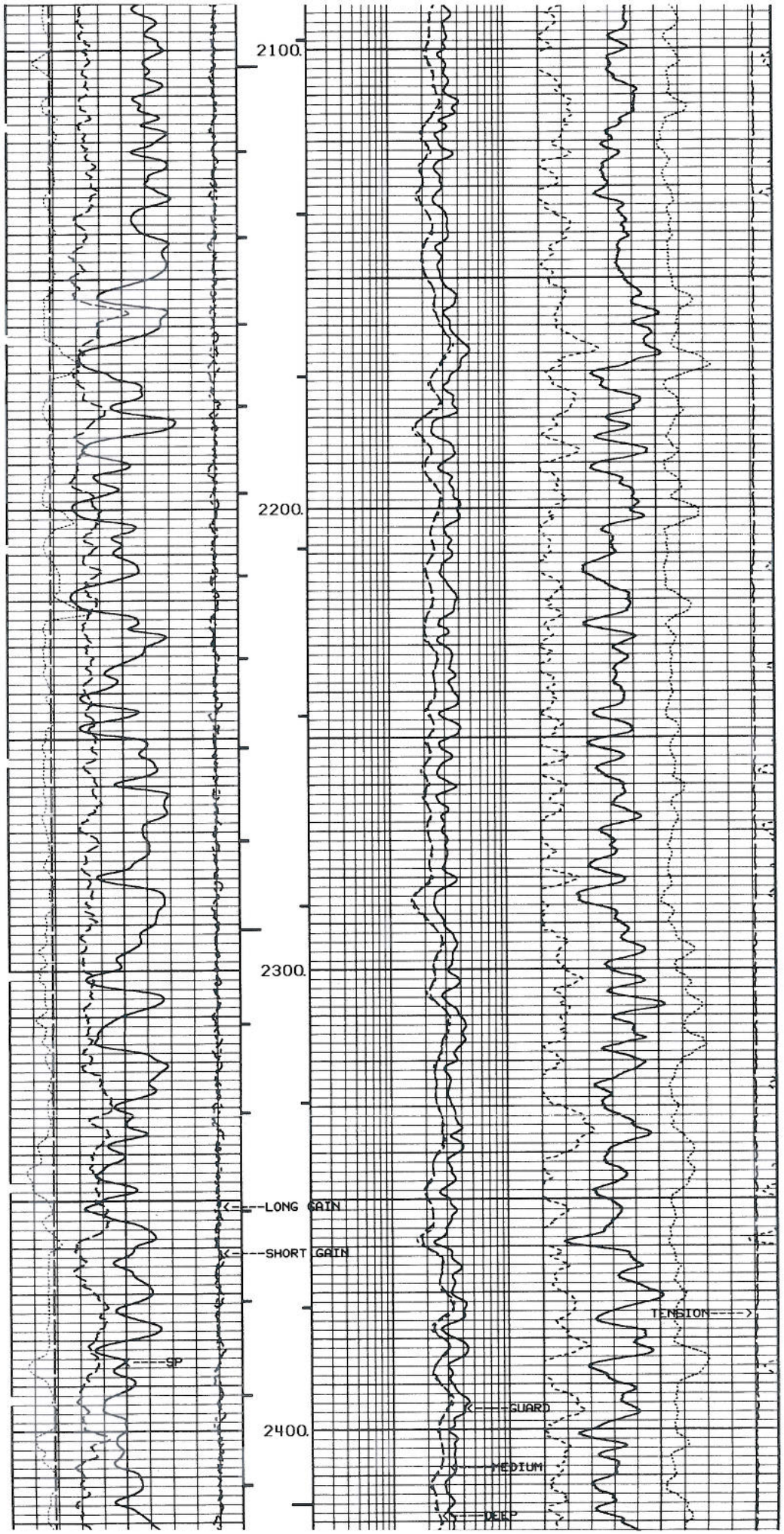
1600.
1700.
DEN POROSITY
NEU POROSITY


1800.
1900.
2000.
2100.
LONG GAIN
SHORT GAIN
SP
BIT SIZE
CALIPER
GAMMA RAY
GUARD
MEDIUM
DEEP
TENSION
DEN. CORR.
BULK DENSITY
DEN POROSITY
NEU POROSITY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2200.
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2400.
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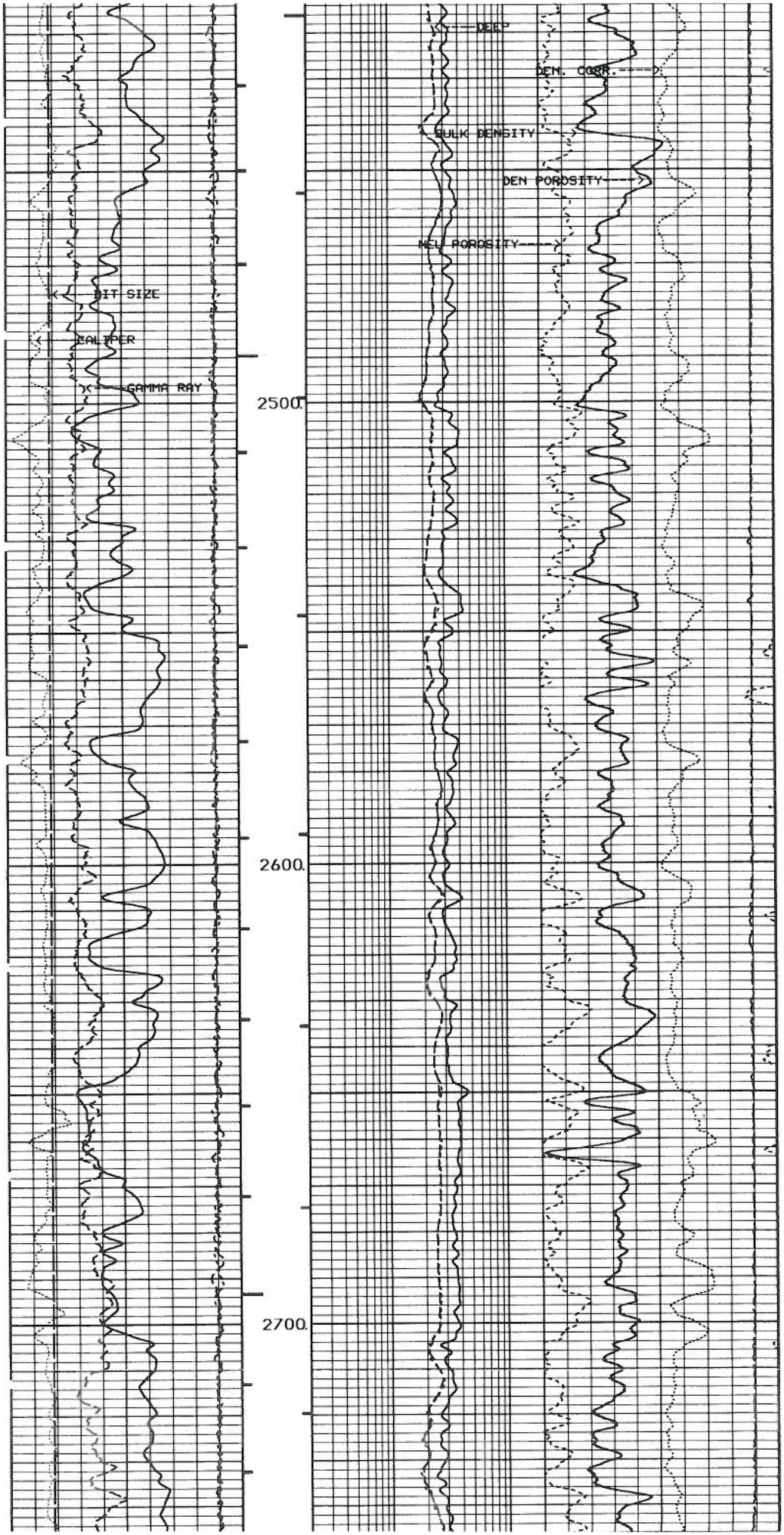
<----SHORT GAIN
----SP
TENSION---->
<----GUARD
----MEDIUM
----DEEP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CALIPER
GAMMA RAY
DEEP
DEN. CORR.
BULK DENSITY
DEN POROSITY
NEU POROSITY
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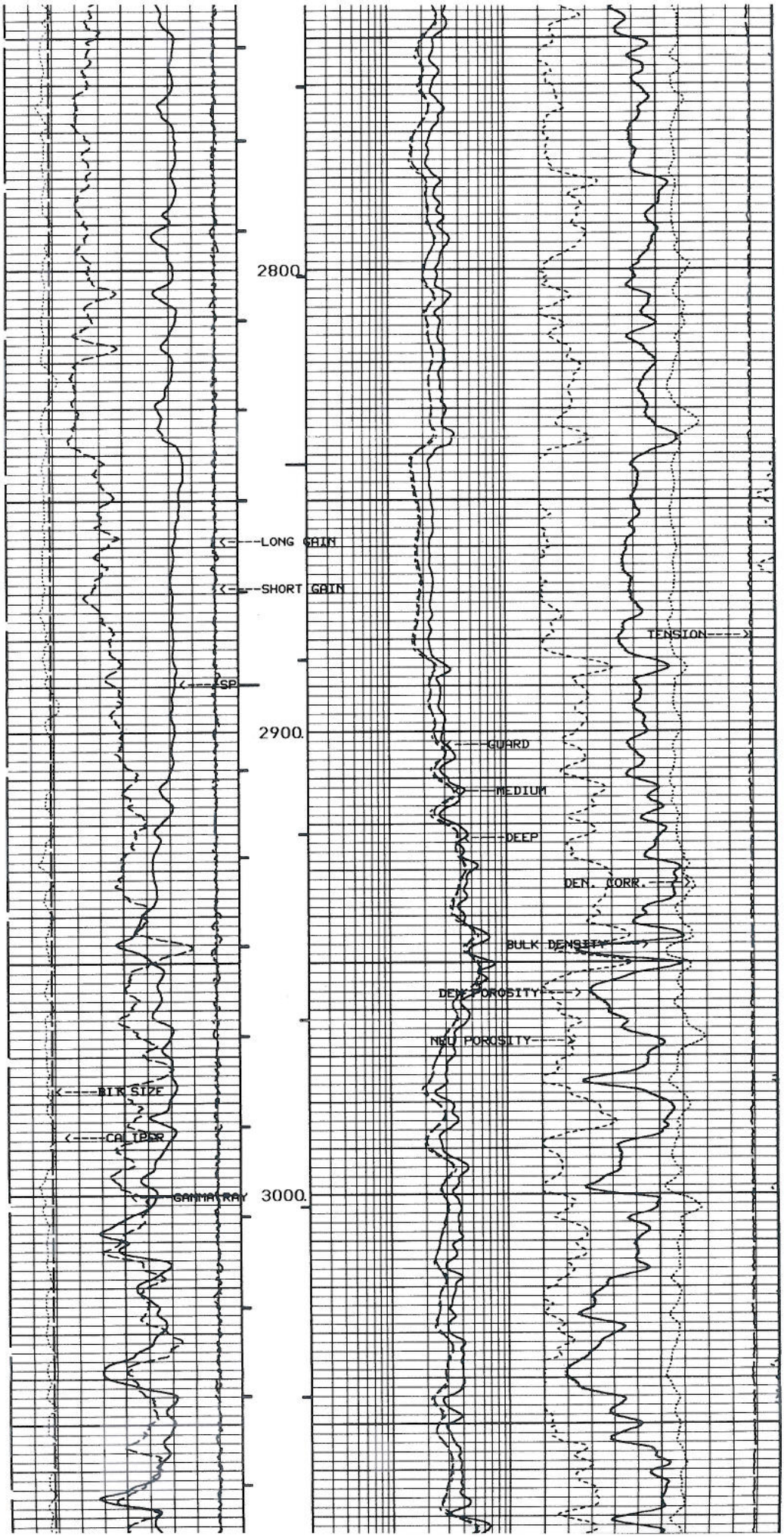
2600.
2700.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2900
3000
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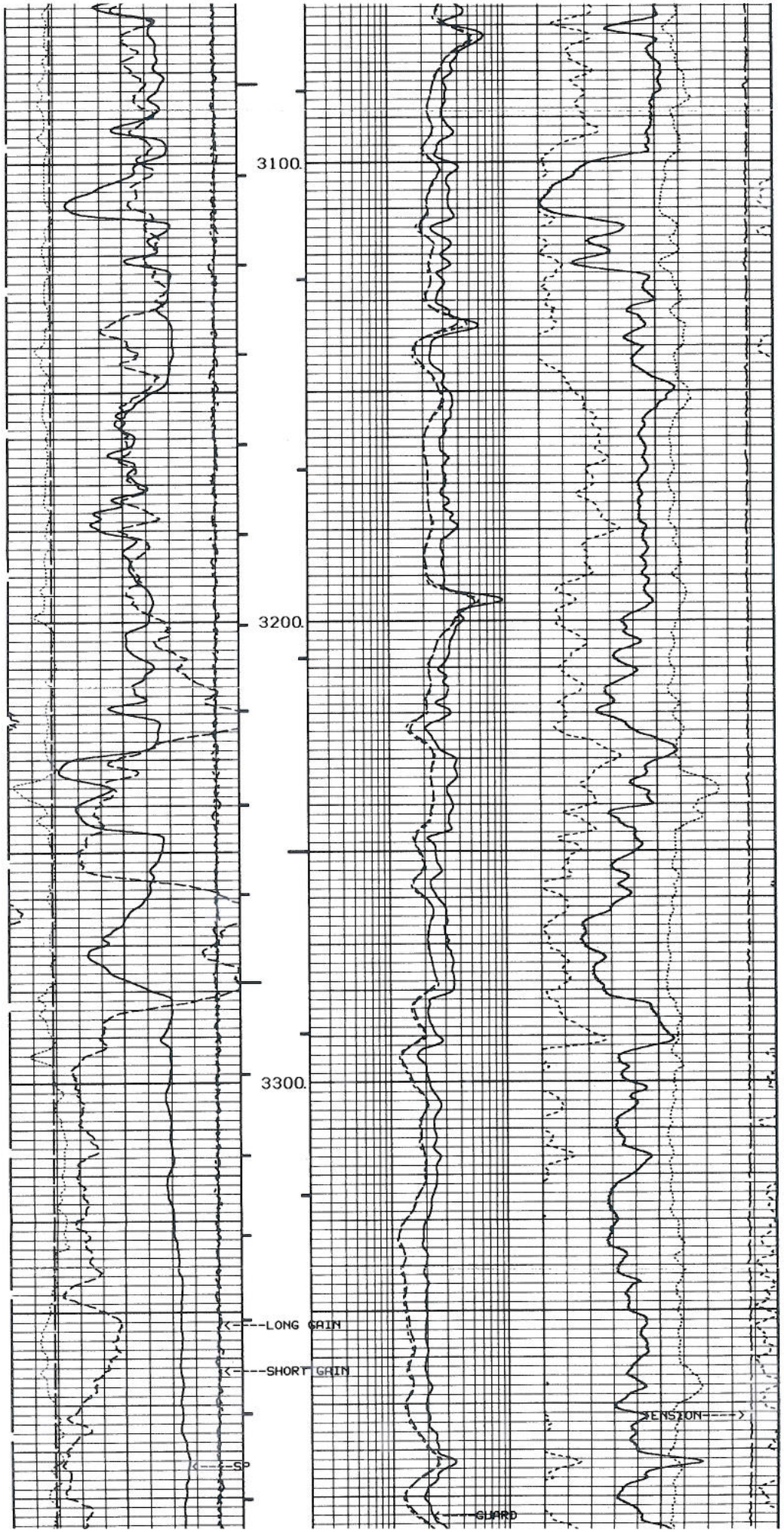
<----SHORT GAIN
<----SP
<----BIT SIZE
<----CALIPER
<----GAMMA RAY
TENSION---->
<----GUARD
<----MEDIUM
<----DEEP
DEN. CORR.---->
BULK DENSITY---->
DEN. POROSITY---->
NEU POROSITY---->
I


3100.
3200.
3300.
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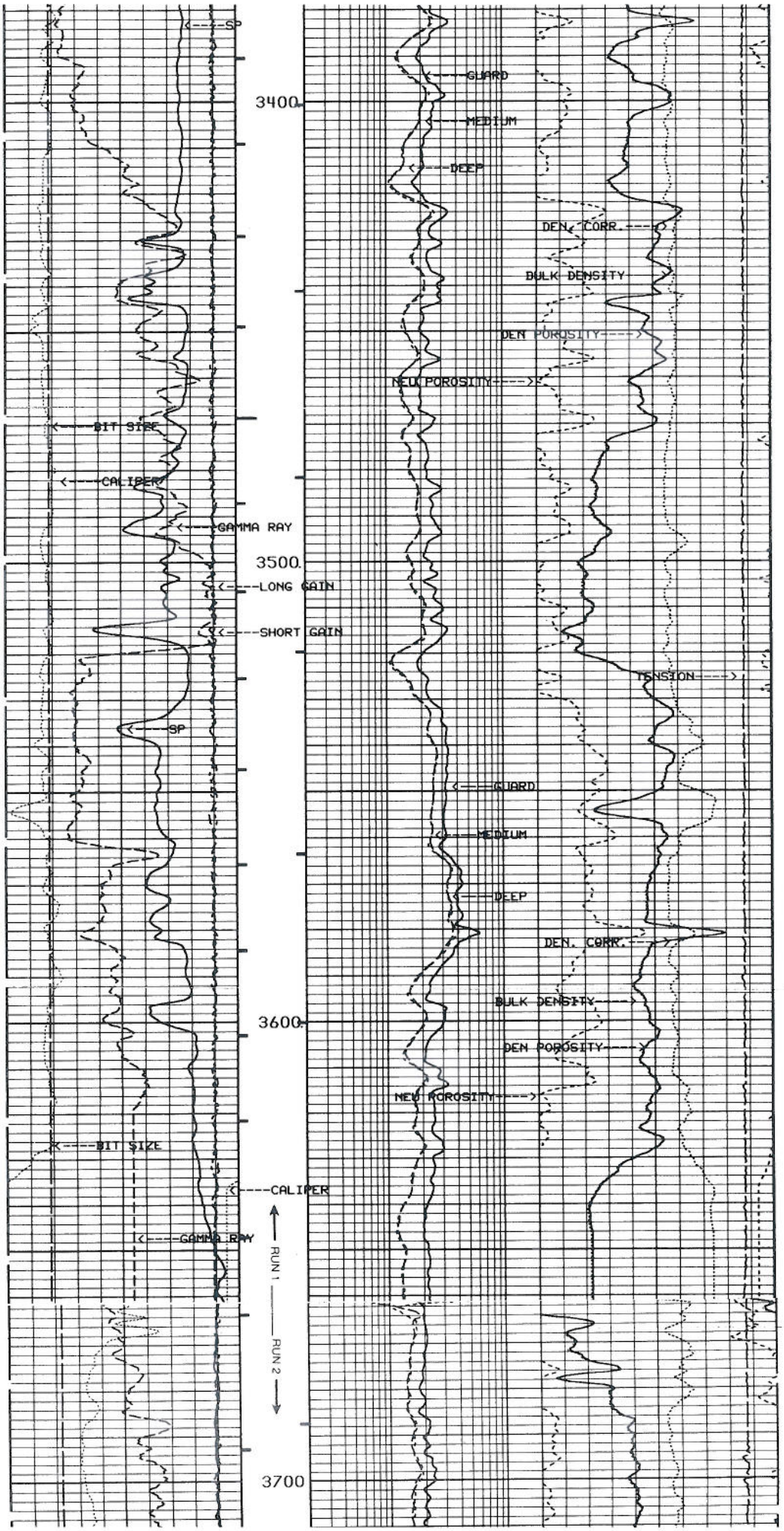
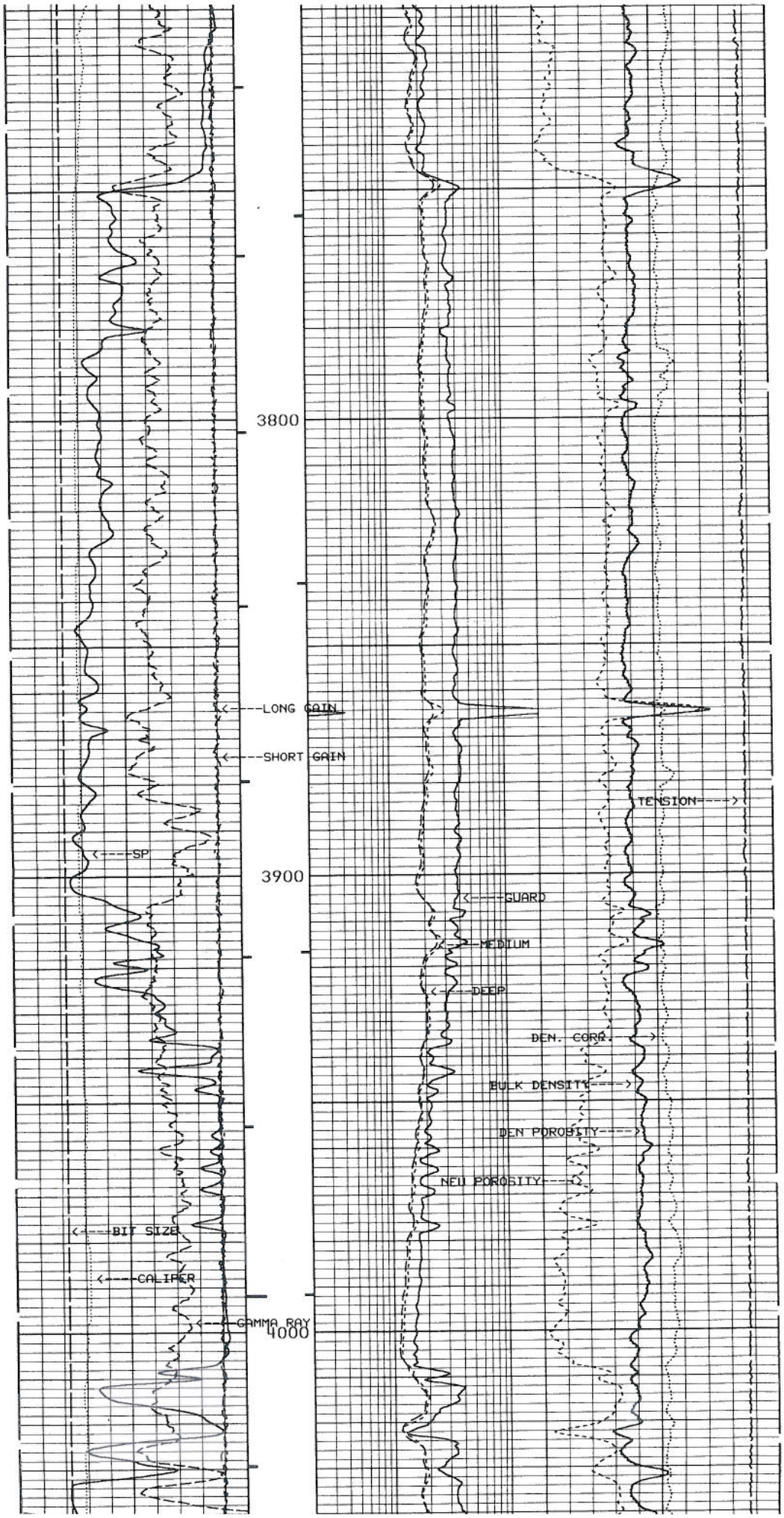
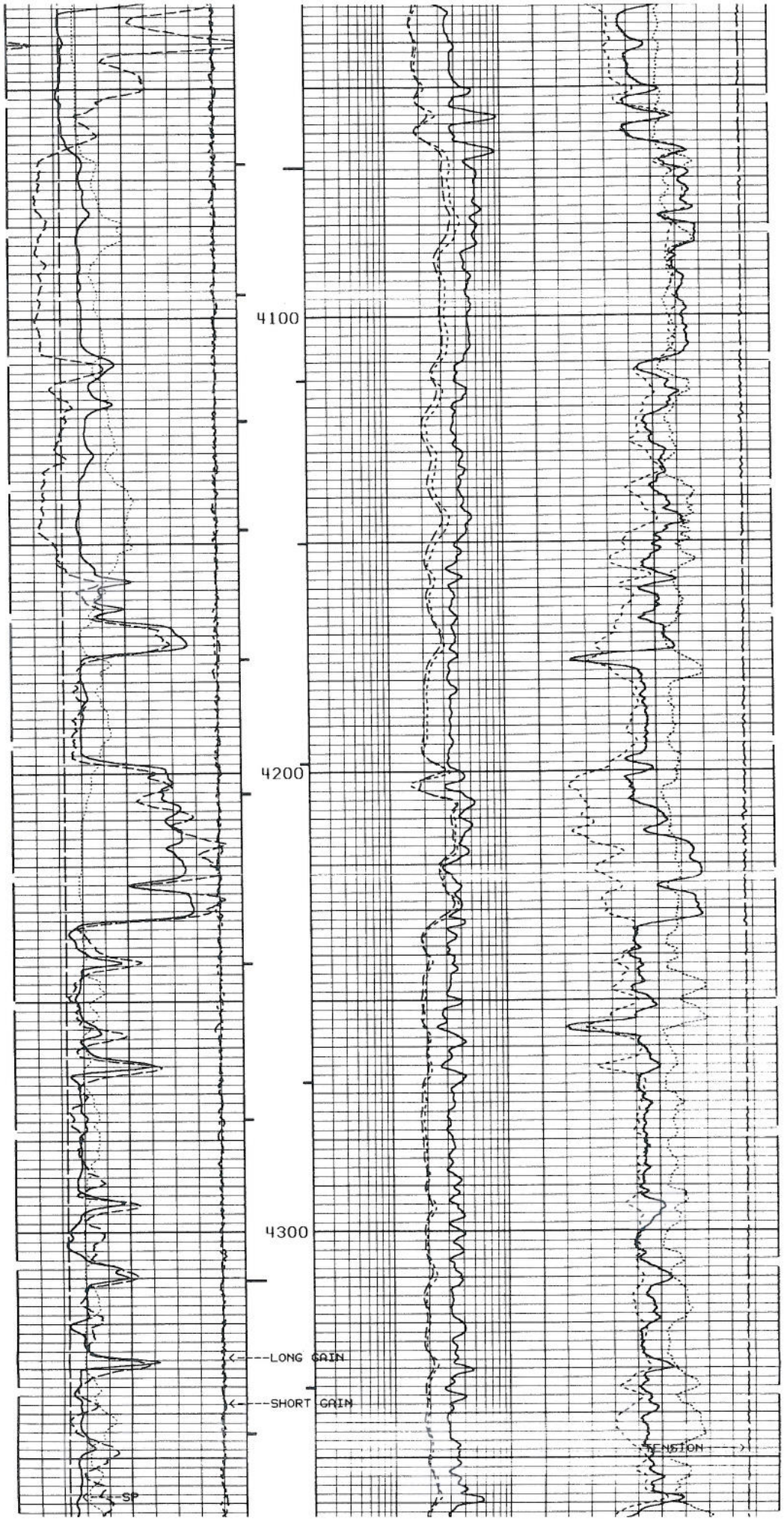
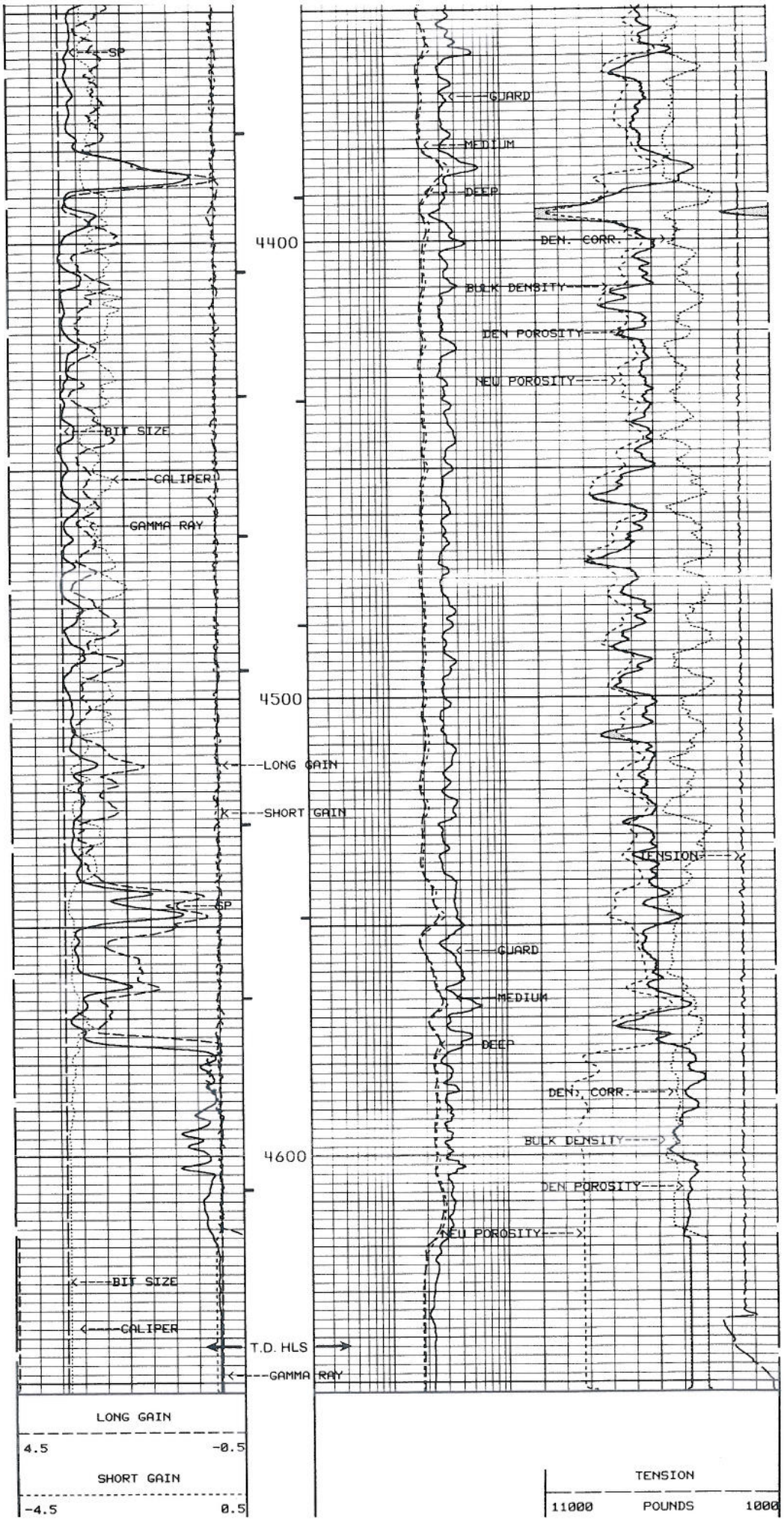
<---SHORT GAIN
<---SP
<---GUARD
TENSION--->


SP
GUARD
MEDIUM
DEEP
DEN. CORR.
BULK DENSITY
DEN POROSITY
NEU POROSITY
BIT SIZE
CALIPER
GAMMA RAY
LONG GAIN
SHORT GAIN
TENSION
SP
GUARD
MEDIUM
DEEP
DEN. CORR.
BULK DENSITY
DEN POROSITY
NEU POROSITY
BIT SIZE
CALIPER
GAMMA RAY
RUN 1
RUN 2
3400
3500
3600
3700


3800
3900
4000
LONG GAIN
SHORT GAIN
SP
BIT SIZE
CALIPER
GAMMA RAY
TENSION
GUARD
MEDIUM
DEEP
DEN. CORR.
BULK DENSITY
DEN POROSITY
NEU POROSITY


4100
4200
4300
<----LONG GAIN
<----SHORT GAIN
<----SP
TENSION --->

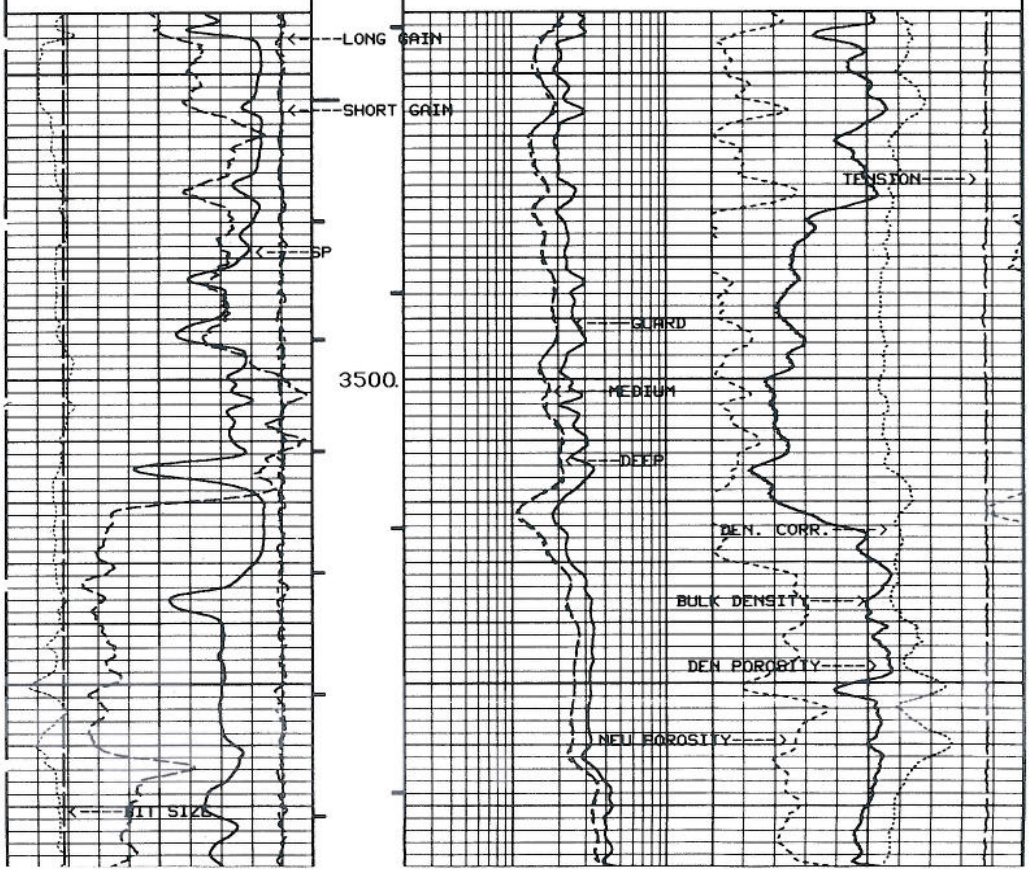

SP
GUARD
MEDIUM
DEEP
4400
DEN. CORR.
BULK DENSITY
DEN POROSITY
NEU POROSITY
BIT SIZE
CALIPER
GAMMA RAY
4500
LONG GAIN
SHORT GAIN
TENSION
SP
GUARD
MEDIUM
DEEP
DEN. CORR.
BULK DENSITY
4600
DEN POROSITY
NEU POROSITY
BIT SIZE
CALIPER
T.D. HLS
GAMMA RAY
LONG GAIN
4.5
-0.5
SHORT GAIN
-4.5
0.5
TENSION
11000
POUNDS
1000

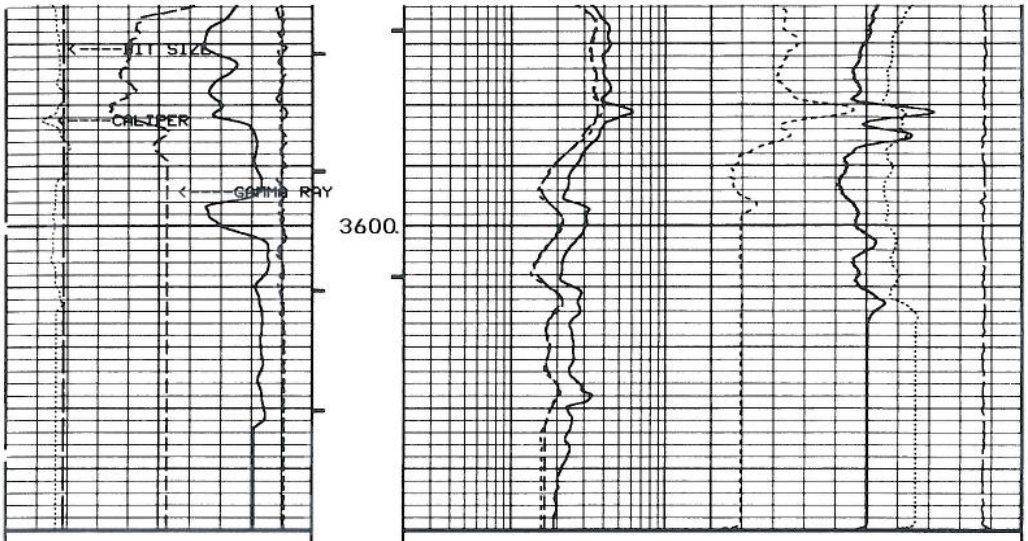
-4.5	SP	0.5				11000	POUNDS	1000
							DEN. CORR.	
	-]10[+ BIT SIZE					-0.5	GM/CC	0.5
					GUARD		BULK DENSITY	
4	INCHES	14		0.2	OHM-M	20	1.65 GM/CC	2.65
	CALIPER		BHV		MEDIUM		DEN POROSITY	
4	INCHES	14	>BHV>	0.2	OHM-M	20	60 PERCENT	0
							MATRIX DENSITY = 2.65	
	GAMMA RAY		AHV		DEEP		NEU POROSITY	
0	API COUNTS	150	<AHV<	0.2	OHM-M	20	60 PERCENT	0
							NEUTRON MATRIX = SAND	

UPLOG # 2 Depth: 4660.00 Service:2100.02 Unit:7626
Realtime Log Date: 7-MAY-1993 Time: 12:50:56 Vers:2.30

RUN 1 REPEAT SECTION

	GAMMA RAY		AHV		DEEP		NEU POROSITY	
0	API COUNTS	150	<AHV<	0.2	OHM-M	20	60 PERCENT	0
							NEUTRON MATRIX = SAND	
	CALIPER		BHV		MEDIUM		DEN POROSITY	
8	INCHES	18	>BHV>	0.2	OHM-M	20	60 PERCENT	0
							MATRIX DENSITY = 2.65	
	BIT SIZE				GUARD		BULK DENSITY	
8	INCHES	18		0.2	OHM-M	20	1.65 GM/CC	2.65
	SP						DEN. CORR.	
	-]10[+ SHORT GAIN						-0.5 GM/CC	0.5
							TENSION	
-4.5	LONG GAIN	0.5					11000 POUNDS	1000
4.5		-0.5						



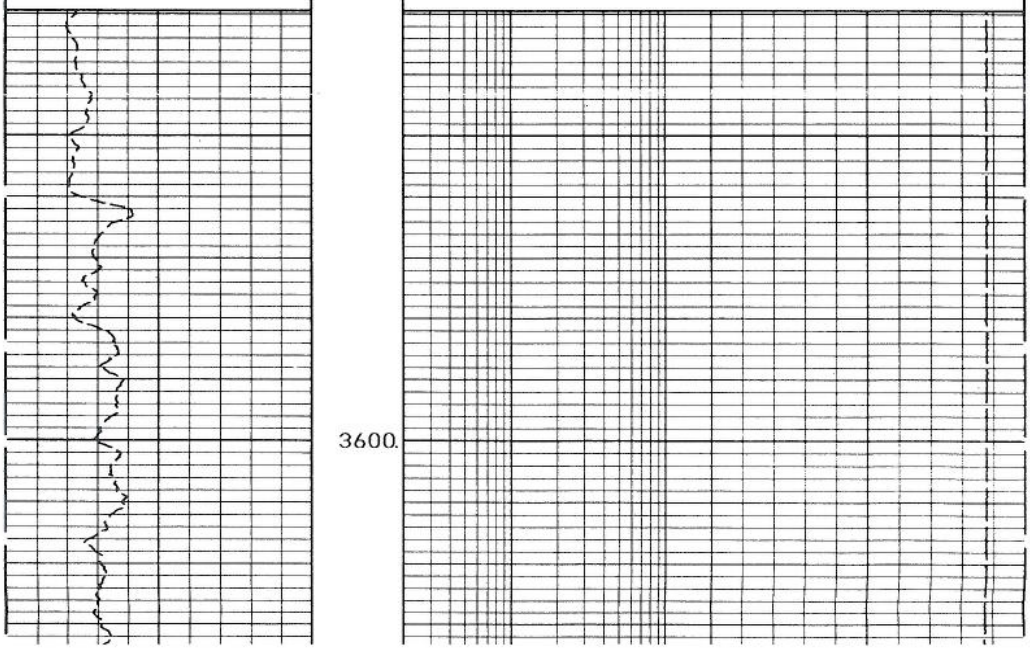


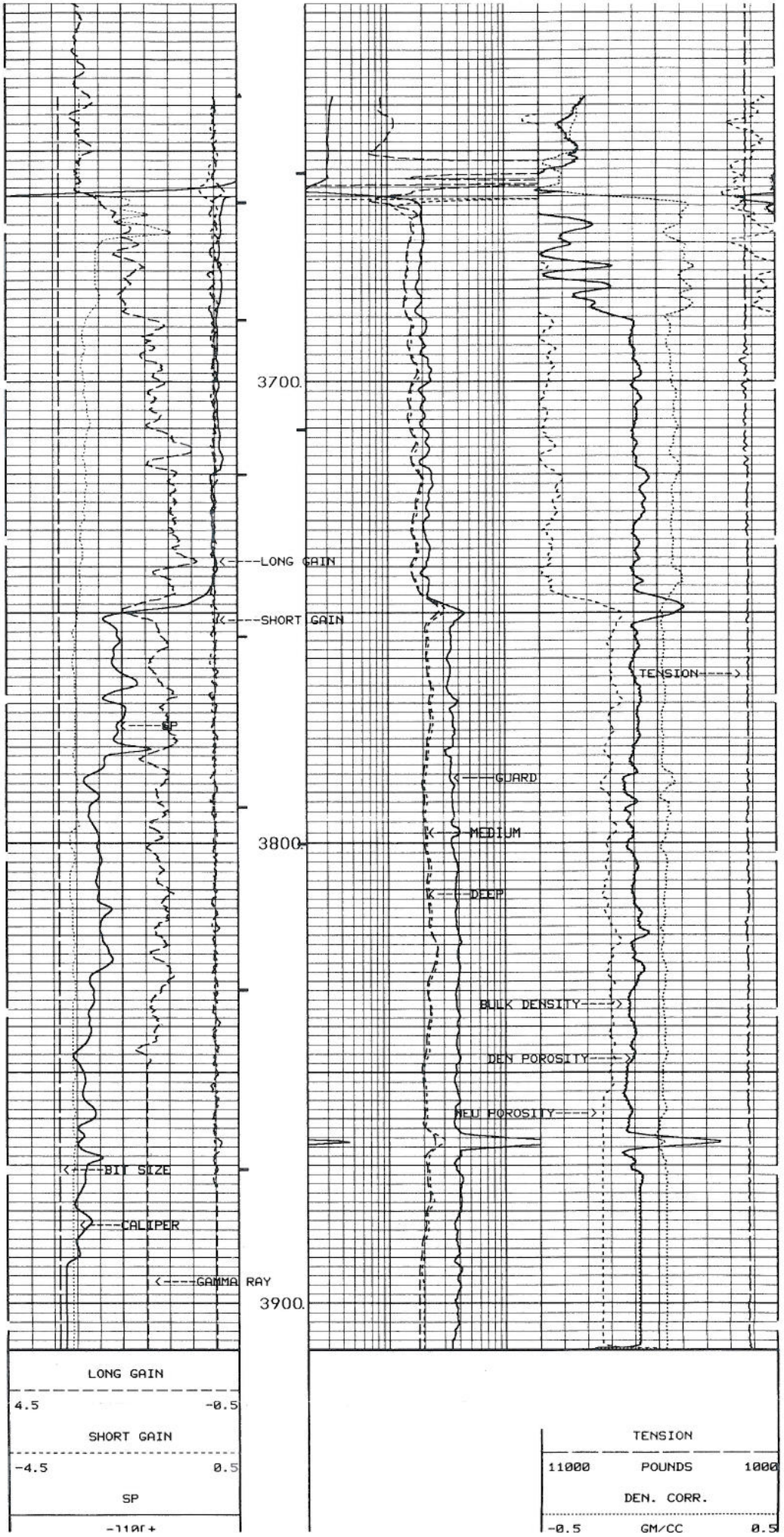
LONG GAIN								
4.5		-0.5						
SHORT GAIN							TENSION	
-4.5		0.5					11000 POUNDS	1000
SP							DEN. CORR.	
-]10[+							-0.5 GM/CC	0.5
BIT SIZE				GUARD			BULK DENSITY	
8	INCHES	18		0.2	OHM-M	20	1.65 GM/CC	2.65
CALIPER			BHV		MEDIUM		DEN POROSITY	
8	INCHES	18	>BHV>	0.2	OHM-M	20	60 PERCENT	0
							MATRIX DENSITY = 2.65	
GAMMA RAY			AHV		DEEP		NEU POROSITY	
0	API COUNTS	150	<AHV<	0.2	OHM-M	20	60 PERCENT	0
							NEUTRON MATRIX = SAND	

UPLOG # 2	Depth: 3650.00	Service:2100.	Unit:7626
Relog	Log Date: 2-MAY-1993	Time: 20:08:43	Vers:2.30

RUN 2 REPEAT SECTION

GAMMA RAY				TENSION	
0	API COUNTS	150		11000 POUNDS	1000




3700.
3800.
3900.
LONG GAIN
SHORT GAIN
SP
BIT SIZE
CALIPER
GAMMA RAY
GUARD
MEDIUM
DEEP
TENSION
BULK DENSITY
DEN POROSITY
NEU POROSITY
LONG GAIN
4.5
-0.5
SHORT GAIN
-4.5
0.5
SP
-110
TENSION
11000
POUNDS
1000
DEN. CORR.
-0.5
GM/CC
0.5

SP				DEN. CORR.
-]10[+				-0.5 GM/CC 0.5
BIT SIZE			GUARD	BULK DENSITY
4 INCHES 14		0.2 OHM-M 20		1.65 GM/CC 2.65
CALIPER	BHV	MEDIUM		DEN POROSITY
4 INCHES 14	>BHV>	0.2 OHM-M 20		60 PERCENT 0 MATRIX DENSITY = 2.65
GAMMA RAY	AHV	DEEP		NEU POROSITY
0 API COUNTS 150	<AHV<	0.2 OHM-M 20		60 PERCENT 0 NEUTRON MATRIX = SAND

UPLOG # 1 Depth: 3910.00 Service:2100. Unit:7626
Replay Log Date: 7-MAY-1993 Time: 12:28:02 Vers:2.30

****

— RUN 1 ___

GAMMA RAY TOOL SHOP CALIBRATION SUMMARY

PERFORMED: 12:22:01 04/30/93 LAST SHOP CALIBRATION: 14:41:43 04/15/93
SERIAL NUMBER: 108581 MODEL: NGRT-A
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

	MEASURED	CALIBRATED	UNITS
BACKGROUND	15	16	GAPI
BACKGROUND+CALIBRATOR	219	221	GAPI
CALIBRATOR	203	205	GAPI

GAMMA RAY TOOL BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 19:22:56 05/ 2/93 LAST SHOP CALIBRATION: 12:22:01 04/30/93

	SHOP	FIELD	UNITS
BACKGROUND	16	93	GAPI
BACKGROUND+CALIBRATOR	221	299	GAPI
CALIBRATOR	205	206	GAPI

GAMMA RAY TOOL AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 21:54:40 05/ 2/93 LAST SHOP CALIBRATION: 12:22:01 04/30/93

	BEFORE	AFTER	UNITS
BACKGROUND	93	117	GAPI
BACKGROUND+CALIBRATOR	299	326	GAPI
CALIBRATOR	206	208	GAPI

****

DUAL SPACED NEUTRON II SHOP CALIBRATION SUMMARY

PERFORMED: 11:30:06 04/30/93 LAST SHOP CALIBRATION: 12:46:37 11/25/92
SERIAL NUMBER: 108751 MODEL: DSNT-A
SOURCE NUM: 25 CALIBR NUM: 4916
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

PRIMARY CALIBRATOR

	MEASURED	CALIBRATED	UNITS
RATIO:	6.391	6.446	
POROSITY:	24.050	24.310	%

FIELD CHECK BLOCK

CHECK RATIO:	7.245	7.308	
CHECK POROSITY:	28.040	28.339	%

DUAL SPACED NEUTRON II BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 18:44:31 05/ 2/93 LAST SHOP CALIBRATION: 11:30:06 04/30/93

	MEASURED	FIELD CALIBRATED	UNITS
CHECK RATIO	7.318	7.308	
CHECK POROSITY	28.385	28.339	%

	EXPECTED	FIELD	DIFFERENCE	TOLERANCE

	[illegible]	2.167	GM/CC
CORRECTION	0.019	0.026	GM/CC
Pe SHORT	4.798	4.759	
Pe LONG	3.887	3.881	

SPECTRAL DENSITY (8 BIT) BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED: 18:37:02 05/ 2/93 LAST SHOP CALIBRATION: 12:00:28 04/30/93

ALUMINUM SLIDE IN	SHOP	FIELD	UNITS
ALUMINUM DENSITY	2.167	2.171	GM/CC
ALUMINUM CORRECTION	0.026	0.030	GM/CC
ALUMINUM PE SHORT	4.759	4.722	
ALUMINUM PE LONG	3.881	3.888	

SPECTRAL DENSITY (8 BIT) AFTER SURVEY FIELD CHECK SUMMARY
PERFORMED: 22:48:08 05/ 2/93 LAST SHOP CALIBRATION: 12:00:28 04/30/93

ALUMINUM SLIDE IN	BEFORE	AFTER	UNITS
ALUMINUM DENSITY	2.171	2.176	GM/CC
ALUMINUM CORRECTION	0.030	0.027	GM/CC
ALUMINUM PE SHORT	4.722	4.716	
ALUMINUM PE LONG	3.888	3.936	

****

SDL CALIPER SHOP CALIBRATION SUMMARY
PERFORMED: 12:05:36 04/30/93 LAST SHOP CALIBRATION: 16:22:49 03/ 9/93
SERIAL NUMBER: 36 MODEL: SDLT-A
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

	MEASURED	CALIBRATED	UNITS
VALUE 1	7.991	8.000	INCH
VALUE 2	15.990	16.000	INCH

SDL CALIPER BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED: 21:42:19 05/ 2/93 LAST SHOP CALIBRATION: 12:05:36 04/30/93

	SHOP	FIELD	UNITS
VALUE 1	8.000	7.751	INCH

SDL CALIPER AFTER SURVEY FIELD CHECK SUMMARY
PERFORMED: 21:44:15 05/ 2/93 LAST SHOP CALIBRATION: 12:05:36 04/30/93

	BEFORE	AFTER	UNITS
VALUE 1	7.751	7.759	INCH

****

DITS DUAL INDUCTION SHOP CALIBRATION SUMMARY
PERFORMED: 16:38:36 04/22/93 LAST SHOP CALIBRATION: 16:36:19 04/22/93
SERIAL NUMBER: BKIWDT MODEL: DILT-A B
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

	DEEP INDUCTION		MEDIUM INDUCTION		
	MEASURED	CALIBRATED	MEASURED	CALIBRATED	UNITS
TOOL ZERO	0.026	0.000	0.031	0.000	MMHOS/M
INTERNAL REFERENCE	497.805	497.525	506.473	506.086	MMHOS/M
WHEEL	500.183	500.000	500.334	500.000	MMHOS/M
MANDREL BASE	3.773	3.793	4.530	4.519	MMHOS/M

DITS DUAL INDUCTION BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED: 19:24:09 05/ 2/93 LAST SHOP CALIBRATION: 16:38:36 04/22/93

	DEEP INDUCTION		MEDIUM INDUCTION		
	SHOP	FIELD	SHOP	FIELD	UNITS
TOOL ZERO	0.000	0.123	0.000	0.138	MMHOS/M
INTERNAL REFERENCE	497.525	495.514	506.086	506.133	MMHOS/M
MANDREL BASE	3.793	3.793	4.519	4.519	MMHOS/M

DITS DUAL INDUCTION AFTER SURVEY FIELD CHECK SUMMARY
PERFORMED: 21:38:58 05/ 2/93 LAST SHOP CALIBRATION: 16:38:36 04/22/93

	DEEP INDUCTION		MEDIUM INDUCTION		
	BEFORE	AFTER	BEFORE	AFTER	UNITS
TOOL ZERO	0.123	0.165	0.138	0.283	MMHOS/M
INTERNAL REFERENCE	495.514	496.442	506.133	508.985	MMHOS/M
MANDREL BASE	3.793	3.793	4.519	4.519	MMHOS/M

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SHORT GUARD SHOP CALIBRATION SUMMARY

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SHORT GUARD SHOP CALIBRATION SUMMARY

PERFORMED: 11:55:47 04/16/93 LAST SHOP CALIBRATION: 14:42:48 03/31/93
SERIAL NUMBER: 108932 MODEL: DSGT-A B
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: R LAWRENCE

	MEASURED	CALIBRATED	UNITS
EXT. CAL. POINT #1	1.990	2.000	OHM-M
EXT. CAL. POINT #2	19.976	20.000	OHM-M
EXT. CAL. POINT #3	200.012	200.000	OHM-M
INTERNAL REFERENCE	19.864	19.887	OHM-M

SHORT GUARD BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 19:25:53 05/ 2/93 LAST SHOP CALIBRATION: 11:55:47 04/16/93

	SHOP	FIELD	UNITS
INTERNAL REFERENCE	19.887	19.856	OHM-M

SHORT GUARD AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 21:39:26 05/ 2/93 LAST SHOP CALIBRATION: 11:55:47 04/16/93

	BEFORE	AFTER	UNITS
INTERNAL REFERENCE	19.856	19.820	OHM-M

PLS-II CALIBRATION SUMMARY TABLE

SERVICE or SIGNAL	SHOP	BEFORE	AFTER	CHANGE	TOLERANCE
GAMMA	205	206	208	-1	+/- 9.0
DSN POROSITY	28.339	28.339	28.129	0.210	+/-0.9
BULK DENSITY	2.167	2.171	2.176	-0.004	+/-.015
DENSITY CORRECTION	0.026	0.030	0.027	0.003	+/-.015
DENSITY PE SHORT	4.759	4.722	4.716	0.006	+/-.3
DENSITY PE LONG	3.881	3.888	3.936	-0.048	+/-.3
CALIPER VALUE 1	8.000	7.751	7.759	-0.008	+/-0.5
DEEP INTERNAL REFERENCE	497.525	495.514	496.442	-0.928	+/-20
MEDIUM INTERNAL REFERENCE	506.086	506.133	508.985	-2.853	+/-20
DEEP TOOL ZERO	0.000	0.123	0.165	-0.042	+/-2
MEDIUM TOOL ZERO	0.000	0.138	0.283	-0.145	+/-2
GUARD	19.887	19.856	19.820	0.036	+/-0.8

****

— RUN 2 —

GAMMA RAY TOOL SHOP CALIBRATION SUMMARY

PERFORMED: 12:22:01 04/30/93 LAST SHOP CALIBRATION: 14:41:43 04/15/93
SERIAL NUMBER: 108581 MODEL: NGRT-A
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

	MEASURED	CALIBRATED	UNITS
BACKGROUND	15	16	GAPI
BACKGROUND+CALIBRATOR	219	221	GAPI
CALIBRATOR	203	205	GAPI

GAMMA RAY TOOL BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 10:53:17 05/ 7/93 LAST SHOP CALIBRATION: 12:22:01 04/30/93

	SHOP	FIELD	UNITS
BACKGROUND	16	47	GAPI
BACKGROUND+CALIBRATOR	221	250	GAPI
CALIBRATOR	205	203	GAPI

GAMMA RAY TOOL AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 14:41:58 05/ 7/93 LAST SHOP CALIBRATION: 12:22:01 04/30/93

	BEFORE	AFTER	UNITS
BACKGROUND	47	49	GAPI
BACKGROUND+CALIBRATOR	250	256	GAPI
CALIBRATOR	203	206	GAPI

****

DUAL SPACED NEUTRON II SHOP CALIBRATION SUMMARY

****

DUAL SPACED NEUTRON II SHOP CALIBRATION SUMMARY

PERFORMED: 15:21:12 03/17/93
SERIAL NUMBER: BLKDSN
SOURCE NUM: DSN-25
TRUCK UNIT NUMBER: 2890
PERFORMED BY: M.SCHWARTZ

LAST SHOP CALIBRATION: 15:18:22 02/17/93
MODEL: DSNT-A
CALIBR NUM: 4916
PROGRAM VERSION: 2.23

PRIMARY CALIBRATOR

	MEASURED	CALIBRATED	UNITS
RATIO:	6.669	6.664	
POROSITY:	25.347	25.322	%

FIELD CHECK BLOCK

CHECK RATIO:	6.989	6.984	
CHECK POROSITY:	26.841	26.815	%

MEAN(1,1) =	0.00
MEAN(1,2) =	0.08
MEAN(2,1) =	0.00
MEAN(2,2) =	0.00
MEAN(3,1) =	9659.37
MEAN(3,2) =	1616.01
MEAN(4,1) =	15735.26
MEAN(5,1) =	7480.24
MEAN(6,1) =	2679.82

DUAL SPACED NEUTRON II BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 11:00:21 05/ 7/93
LAST SHOP CALIBRATION: 15:21:12 03/17/93

	SHOP	FIELD	UNITS
CHECK RATIO	6.984	6.955	
CHECK POROSITY	26.815	26.682	%

DUAL SPACED NEUTRON II AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 14:39:19 05/ 7/93
LAST SHOP CALIBRATION: 15:21:12 03/17/93

	BEFORE	AFTER	UNITS
CHECK RATIO	6.955	6.994	
CHECK POROSITY	26.682	26.863	%

****

SPECTRAL DENSITY (8 BIT) SHOP CALIBRATION SUMMARY

PERFORMED: 12:00:28 04/30/93
SERIAL NUMBER: 109723
TRUCK UNIT NUMBER: 7626
PERFORMED BY: M.SCHWARTZ

LAST SHOP CALIBRATION: 16:16:33 03/ 9/93
MODEL: SDLT-A B
PROGRAM VERSION: 2.30

PRIMARY CALIBRATOR

MAGNESIUM BLOCK

	MEASURED	CALIBRATED	UNITS
DENSITY	1.672	1.678	GM/CC
CORRECTION	0.010	0.018	GM/CC
Pe SHORT	3.197	3.173	
Pe LONG	2.882	2.867	

ALUMINUM BLOCK

	MEASURED	CALIBRATED	UNITS
DENSITY	2.600	2.603	GM/CC
CORRECTION	0.044	0.051	GM/CC
Pe SHORT	3.225	3.200	
Pe LONG	3.252	3.240	

ALUMINUM BLOCK W/SLEEVE

	MEASURED	CALIBRATED	UNITS
DENSITY	2.593	2.592	GM/CC
CORRECTION	-0.049	-0.046	GM/CC
Pe SHORT	6.061	6.010	
Pe LONG	6.024	6.040	

CALIBRATION COEFFICIENTS

	EXPECTED RANGE	CALIBRATED	UNITS
SHORT SPACE			
DENSITY SLOPE	-6.40 -> -7.60	-6.950	GM/CC
DENSITY INTERCEPT	27.00 -> 37.00	31.886	GM/CC
PE SLOPE	1.20 -> 2.30	1.756	
PE INTERCEPT	-2.20 -> -4.00	-2.620	
LONG SPACE			

SHORT SPACE

DENSITY SLOPE	-6.40 -> -7.60	-6.950	GM/CC
DENSITY INTERCEPT	27.00 -> 37.00	31.886	GM/CC
PE SLOPE	1.20 -> 2.30	1.756	
PE INTERCEPT	-2.20 -> -4.00	-2.620	

LONG SPACE

DENSITY SLOPE	-1.29 -> -1.39	-1.342	GM/CC
DENSITY INTERCEPT	7.00 -> 8.10	7.592	GM/CC
PE SLOPE	1.30 -> 2.50	1.752	
PE INTERCEPT	-0.70 -> -2.10	-1.331	

FIELD CHECK BLOCK

ALUMINUM SLIDE IN

	MEASURED	CALIBRATED	UNITS
DENSITY	2.163	2.167	GM/CC
CORRECTION	0.019	0.026	GM/CC
Pe SHORT	4.798	4.759	
Pe LONG	3.887	3.881	

SPECTRAL DENSITY (8 BIT) BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED: 11:04:30 05/ 7/93 LAST SHOP CALIBRATION: 12:00:28 04/30/93

ALUMINUM SLIDE IN	SHOP	FIELD	UNITS
ALUMINUM DENSITY	2.167	2.164	GM/CC
ALUMINUM CORRECTION	0.026	0.026	GM/CC
ALUMINUM PE SHORT	4.759	4.742	
ALUMINUM PE LONG	3.881	3.980	

SPECTRAL DENSITY (8 BIT) AFTER SURVEY FIELD CHECK SUMMARY
PERFORMED: 14:33:50 05/ 7/93 LAST SHOP CALIBRATION: 12:00:28 04/30/93

ALUMINUM SLIDE IN	BEFORE	AFTER	UNITS
ALUMINUM DENSITY	2.164	2.162	GM/CC
ALUMINUM CORRECTION	0.026	0.024	GM/CC
ALUMINUM PE SHORT	4.742	4.697	
ALUMINUM PE LONG	3.980	3.967	

****

SDL CALIPER SHOP CALIBRATION SUMMARY
PERFORMED: 12:05:36 04/30/93 LAST SHOP CALIBRATION: 16:22:49 03/ 9/93
SERIAL NUMBER: 36 MODEL: SDLT-A
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

	MEASURED	CALIBRATED	UNITS
VALUE 1	7.991	8.000	INCH
VALUE 2	15.990	16.000	INCH

SDL CALIPER BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED: 10:56:22 05/ 7/93 LAST SHOP CALIBRATION: 12:05:36 04/30/93

	SHOP	FIELD	UNITS
VALUE 1	8.000	8.009	INCH

SDL CALIPER AFTER SURVEY FIELD CHECK SUMMARY
PERFORMED: 14:38:58 05/ 7/93 LAST SHOP CALIBRATION: 12:05:36 04/30/93

	BEFORE	AFTER	UNITS
VALUE 1	8.009	7.667	INCH

****

DITS DUAL INDUCTION SHOP CALIBRATION SUMMARY
PERFORMED: 15:16:32 04/22/93 LAST SHOP CALIBRATION: 15:12:24 04/22/93
SERIAL NUMBER: WDIBKT MODEL: DILT-A B
TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30
PERFORMED BY: M.SCHWARTZ

	DEEP INDUCTION		MEDIUM INDUCTION		
	MEASURED	CALIBRATED	MEASURED	CALIBRATED	UNITS
TOOL ZERO	-0.145	0.000	-0.012	0.000	MMHOS/M
INTERNAL REFERENCE	503.400	502.516	500.781	499.649	MMHOS/M
WHEEL	500.857	500.000	501.148	500.000	MMHOS/M
MANDREL BASE	2.426	2.330	0.794	0.791	MMHOS/M

DITS DUAL INDUCTION BEFORE SURVEY FIELD CHECK SUMMARY
PERFORMED: 12:25:01 05/ 7/93 LAST SHOP CALIBRATION: 15:16:32 04/22/93

	DEEP INDUCTION		MEDIUM INDUCTION		
	SHOP	FIELD	SHOP	FIELD	UNITS

	DEEP INDUCTION SHOP	DEEP INDUCTION FIELD	MEDIUM INDUCTION SHOP	MEDIUM INDUCTION FIELD	UNITS
TOOL ZERO	0.000	0.476	0.000	-0.257	MMHOS/M
INTERNAL REFERENCE	502.516	503.641	499.649	501.388	MMHOS/M
MANDREL BASE	2.330	2.330	0.791	0.791	MMHOS/M

DITS DUAL INDUCTION AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 13:49:50 05/ 7/93 LAST SHOP CALIBRATION: 15:16:32 04/22/93

	DEEP INDUCTION BEFORE	DEEP INDUCTION AFTER	MEDIUM INDUCTION BEFORE	MEDIUM INDUCTION AFTER	UNITS
TOOL ZERO	0.476	2.876	-0.257	-0.485	MMHOS/M
INTERNAL REFERENCE	503.641	512.037	501.388	502.624	MMHOS/M
MANDREL BASE	2.330	2.330	0.791	0.791	MMHOS/M

****

SHORT GUARD SHOP CALIBRATION SUMMARY

PERFORMED: 16:20:54 04/22/93 LAST SHOP CALIBRATION: 10:16:43 04/21/93

SERIAL NUMBER: 108940B MODEL: DSGT-A B

TRUCK UNIT NUMBER: 7626 PROGRAM VERSION: 2.30

PERFORMED BY: M.SCHWARTZ

	MEASURED	CALIBRATED	UNITS
EXT. CAL. POINT #1	2.032	2.000	OHM-M
EXT. CAL. POINT #2	20.005	20.000	OHM-M
EXT. CAL. POINT #3	199.824	200.000	OHM-M
INTERNAL REFERENCE	19.758	19.763	OHM-M

SHORT GUARD BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 12:21:31 05/ 7/93 LAST SHOP CALIBRATION: 16:20:54 04/22/93

	SHOP	FIELD	UNITS
INTERNAL REFERENCE	19.763	19.554	OHM-M

SHORT GUARD AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 13:50:18 05/ 7/93 LAST SHOP CALIBRATION: 16:20:54 04/22/93

	BEFORE	AFTER	UNITS
INTERNAL REFERENCE	19.554	19.607	OHM-M

PLS-II CALIBRATION SUMMARY TABLE

SERVICE or SIGNAL	SHOP	BEFORE	AFTER	CHANGE	TOLERANCE
GAMMA	205	203	206	-3	+/- 9.0
DSN POROSITY	26.815	26.682	26.863	-0.182	+/-0.9
BULK DENSITY	2.167	2.164	2.162	0.002	+/-.015
DENSITY CORRECTION	0.026	0.026	0.024	0.002	+/-.015
DENSITY PE SHORT	4.759	4.742	4.697	0.044	+/-.3
DENSITY PE LONG	3.881	3.980	3.967	0.013	+/-.3
CALIPER VALUE 1	8.000	8.009	7.667	0.342	+/-0.5
DEEP INTERNAL REFERENCE	502.516	503.641	512.037	-8.397	+/-20
MEDIUM INTERNAL REFERENCE	499.649	501.388	502.624	-1.236	+/-20
DEEP TOOL ZERO	0.000	0.476	2.876	-2.400	+/-2
MEDIUM TOOL ZERO	0.000	-0.257	-0.485	0.228	+/-2
GUARD	19.763	19.554	19.607	-0.053	+/-0.8

HLS

PLS-II TOOL STRING DIAGRAM

7-MAY-1993 13:44:02

```
+===+ <----  75.3800 = TELEMETRY SUB
:   :
:   :
:   :
:   :
:   :
:   :
+===+ <----  68.8800 = GAMMA SUB
:   :
:   :
:   :
:   :
:   :
:   : <----  62.2100 = GAMMA RAY
:   :
+===+ <----  60.8800 = DSN-II SUB
:   :
:   :
:   :
```

```
+===+ <----  60.8800 = DSN-II SUB

+===+ <----  52.6300 = DSN

+===+ <----  50.6300 = SPECTRAL DENSITY SUB

 /:    : \
/ :    : ::  50.6300
:  :    : :: <-  35.9700 = CALIPER
:  :    : :: <-  34.8000 = DENSITY
:    : ++

+===+ <----  31.8000 = DUAL INDUCTION SUB

:    : <----  16.7500  = SP
:    : <----  16.7500  = DEEP INDUCTION

:    : <----  13.0000  = MEDIUM INDUCTION

+===+ <----  4.00000 = SHORT GUARD SUB

:    : <----  2.00000 = SHORT GUARD

+---+
```

COMPANY NORTHERN CALIFORNIA POWER AGENCY
WELL "Lodi STIG" No. 1
FIELD Lodi
LOCATION Sec. 24, T3N-R5E; MDB&M
Fr SW cor 478'N 83'E
COUNTY San Joaquin STATE CA
ELEVATION 6'GL; 20'KB
API WELL INDEX NO. 04-077-20567
SPUD DATE 29 April 93 TIME 4:00PM
LOG DATES 30 April 93 TO 7 May 93
LOG DEPTHS 614' TO 4650'
LOGGING GEOLOGISTS Ben Cahill
John Locke
ENERGYLOG UNIT Hawaii
CO. GEOLOGIST Bill Smith
CO. ENGINEER
CO. PUSHER Dennis Brown
DRILLING CO. Paul Graham Drilling Co.
RIG Two PUSHER G. L. "Tex" Hillmon
MUD COMPANY GEO Western
MUD ENGINEER Gary Roberts
MUD TYPE Cypan

PUMPS: No. 1 OPI 700 5 1/2" X 8"
No. 2 National 7-P-50 5 1/2" X 8"

HOLE SIZE			CASING SIZE		
14 3/4"	TO	614'	10 3/4"	TO	614'
9 7/8"	TO	3675'	7 "	TO	3674'
6 1/4"	TO	4650'		TO	
	TO			TO	

ENERGYLOG

ENERGY WELL LOGGING SERVICE

LITHOLOGY SYMBOLS

CHERT, VOLCANICS, INTRUSIVE, LIMESTONE, DOLOMITE, GYPSUM AND ANHYDRITE, SALT, COAL AND LIGNITE, CLAY, SHALE, SILTSTONE, SANDY SILTST, SAND, UNCONSOL. GRANULATE

MUD DATA
- w WEIGHT
- v VISCOSITY
- f FILTRATE
- fc FILTER CAKE
- sd SAND % VOL
- s SALINITY ppm Cl
- sol SOLIDS % VOL
- T TEMPERATURE° F
- Rm RESISTIVITY OF MUD at 75°F
- Rf RESISTIVITY OF FILTRATE at 75°F

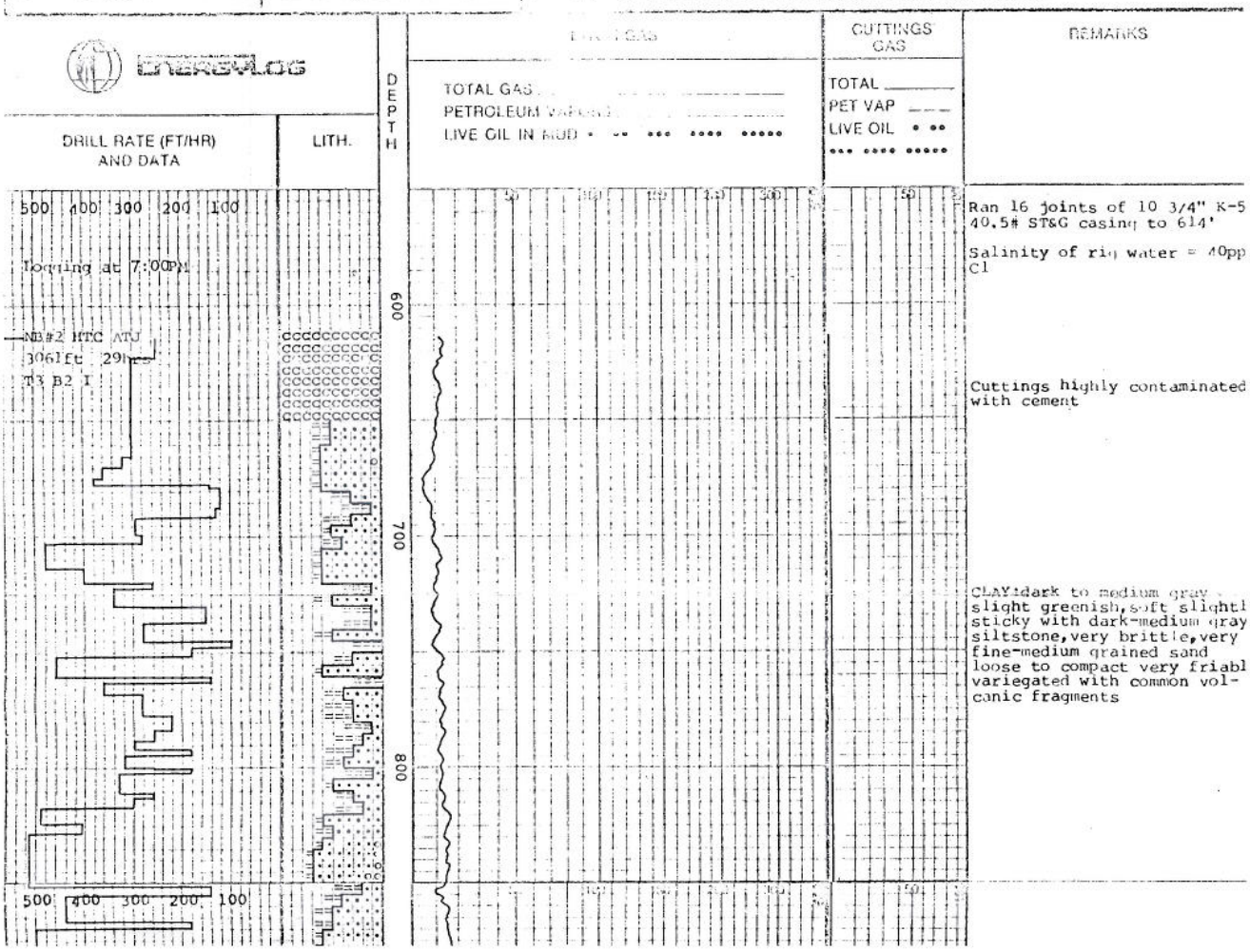
DRILLING DATA
- NB NEW BIT
- [illegible] [illegible] BIT
- RTS [illegible] BIT
- Cb CORE BIT
- WOB WEIGHT ON BIT (lbs.)
- RPM ROTARY REVS/MIN
- Pp PUMP PRESSURE (psi)
- [illegible] STROKES/MINUTE

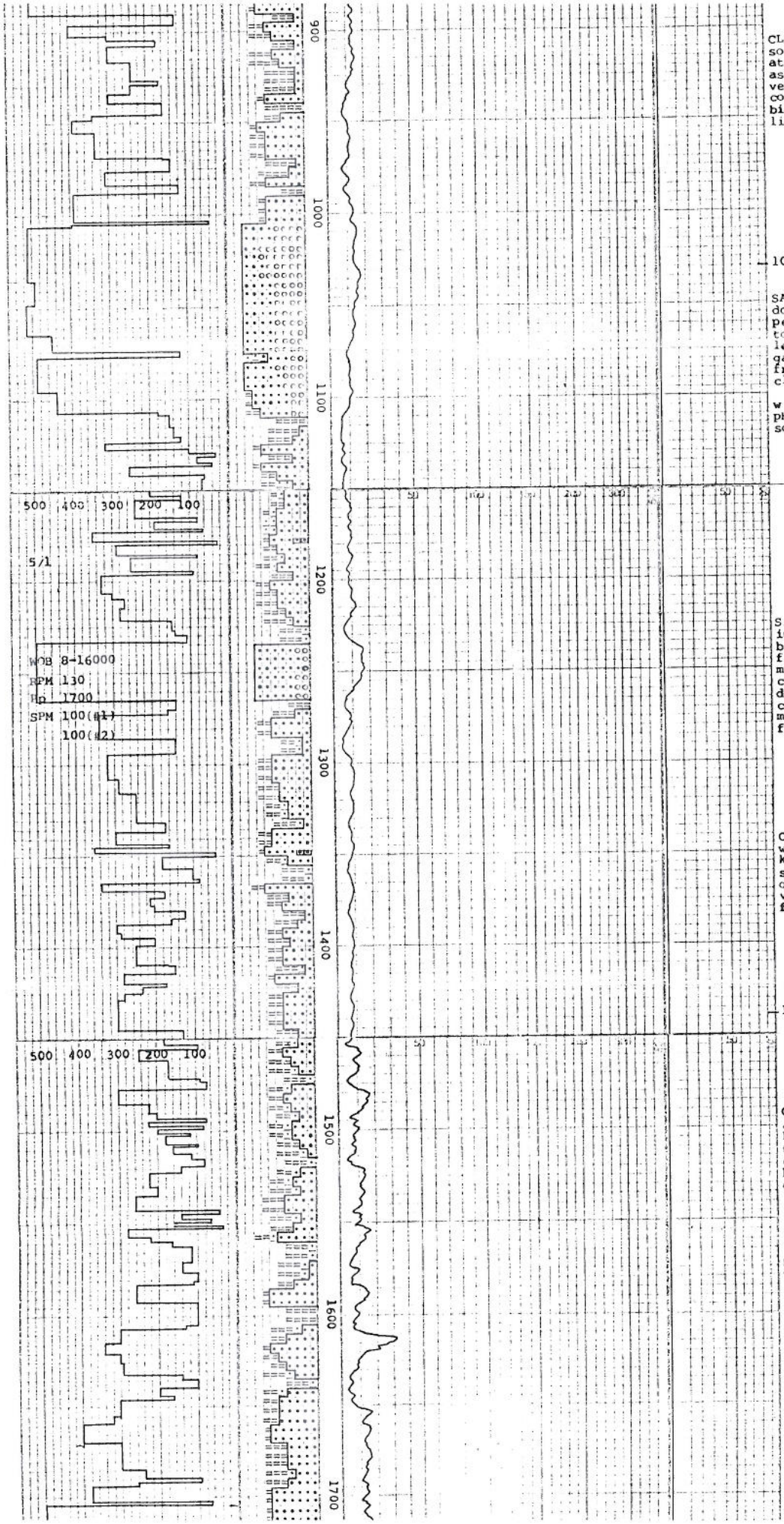
OTHER DATA
- TG TRIP GAS
- STG SHORT TRIP GAS
- CG CONNECTION GAS
- CR CIRCULATED RETURNS
- NR NO RETURNS
- LAT LOGGED AFTER TRIP
- C CARBIDE
- DST DRILL STEM TEST
-] DST INTERVAL
- [CORE INTERVAL
- ▲ CASING POINT

DIRECT. CO.
DIRECT. ENGR.
DIRECT. K.O.P.

LIVE OIL IN MUD OR CUTTINGS
- • SLIGHT TRACE
- •• TRACE
- ••• FAIR
- •••• GOOD
- ••••• EXCELLENT

[illegible] live oil in unwashed cuttings, mud, and % staining of washed cuttings.
[illegible] calibration records 100 units with a mixture of 2% by volume methane in air.
[illegible] values at parts per million (PPM).
[illegible] from drillers pipe measurements at kelly bushing.





CLAY:medium gray to green, soft moderately soluble mode ately sticky very silty to ashy common interbeds of sar very fine to coarse grained common clear quartz abundant biotite flakes variegated lithic fragments

1030' 0°15'

SAND:dark gray cuttings, pr dominantly very coarse to pebbly, clear angular quart to well rounded basalt pebb les, abundant biotite varie gated varicolored lithic fragments, minor gray-green clay

w 79 v 38 f 7.8 fc 2/32
pH 11.1 s 750 sd 3/4%
sol 14%

SAND: dark gray cuttings, m ium to coarse grained to pe bly, angular to well rounde fair to poor sorting with minor clay matrix, common clear to frosted quartz abu dant biotite, variegated va colored lithic fragments co mon volcanic and metamorphi fragments thru out

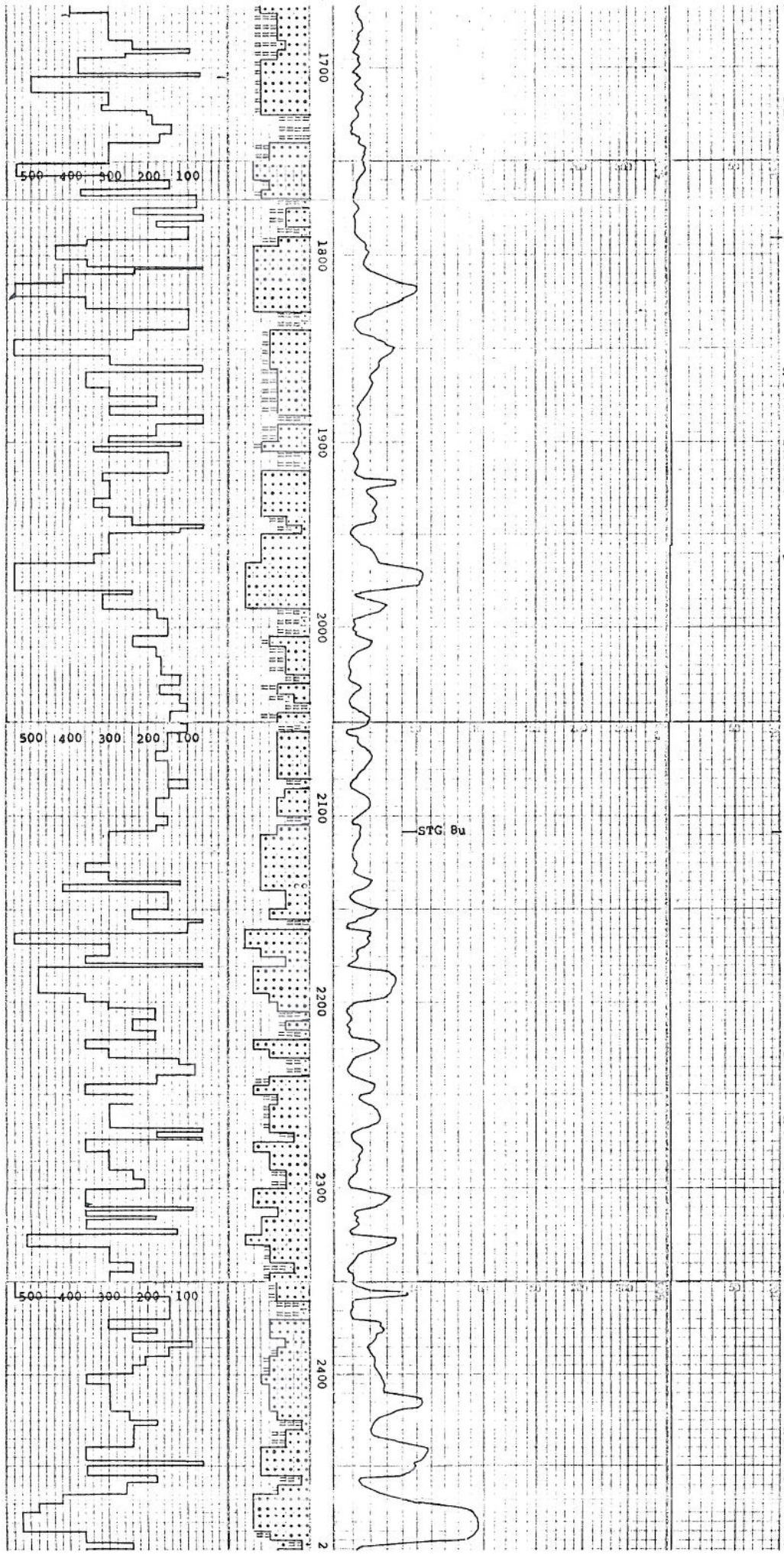
CLAY: medium gray, minor white kaolin, moderately st ky to soluble very silty- sandy, very fine sand comm quartz with abundant biotit variegated varicolored lith fragments

1439' 0°00'

CLAY: medium gray, well hy ated slightly sticky inter bedded with sand, very fin to medium grained common clear-milky quartz abundan biotite variegated varicol ed lithic fragments

Rm 2.16 Rf 2.14 S 780
T 102°

SAND: dark brown cuttings, very fine grained slightly compacted tuffaceous sand- stone very friable very sl common variegated varicolo granules



CLAY: light green-gray, so
moderately soluble slightl
sticky very silty

1792' 0° 15'

SAND: dark gray-green to
dark gray-brown cuttings,
fine to coarse grained poo
sorted predominantly tuff
fragments, common subangul
clear-milky quartz, abunda
muscovite and biotite inte
bedded with medium green
sticky to moderately solub
claystone, possibly highly
altered tuff beds

w 73 v 38

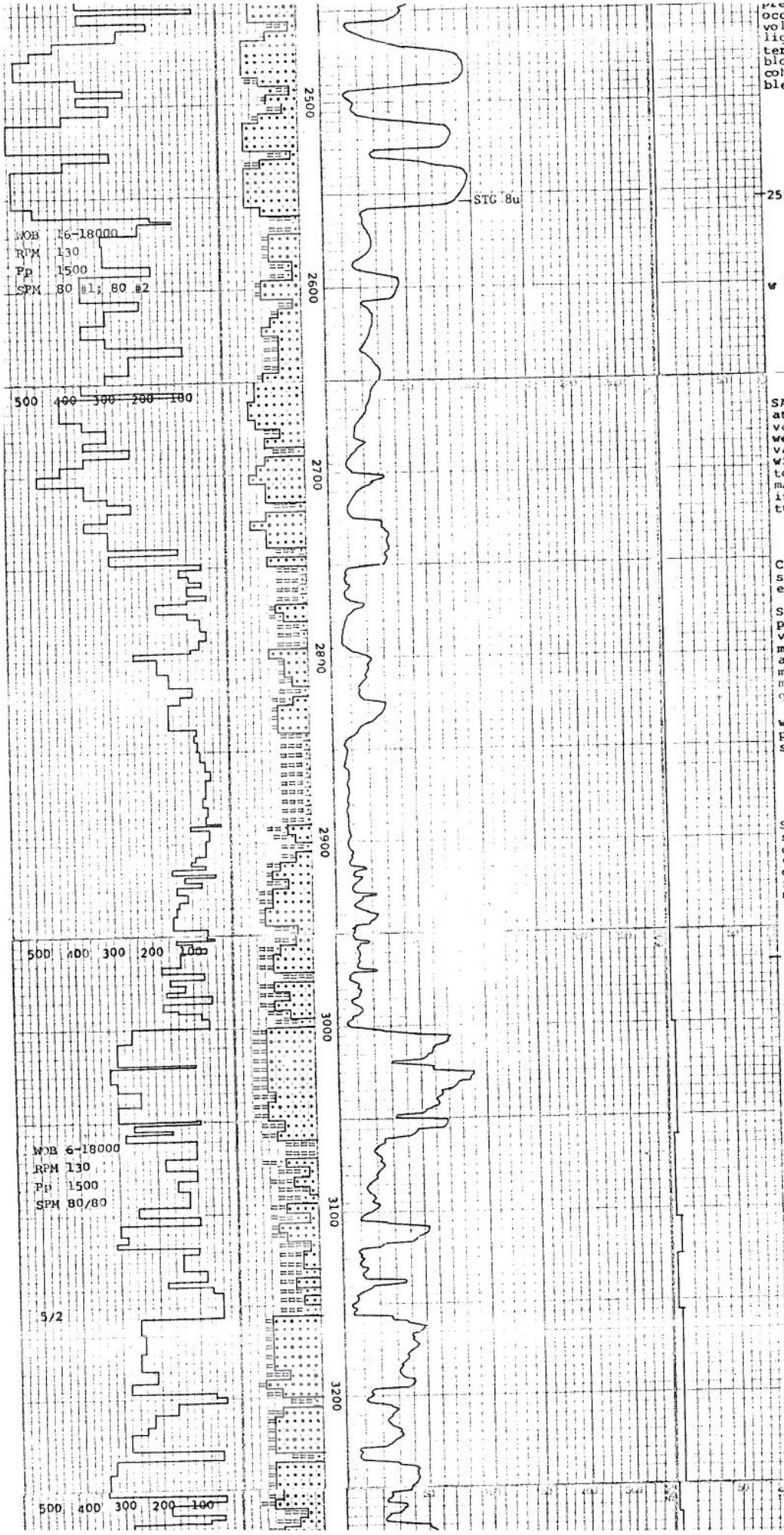
2109' 0° 30'

SAND: medium to dark gray
cuttings, predominantly tu
fragments with occasional
rounded basalt pebbles in
gray-green clay matrix, co
mon thin beds gray-green
clay possible altered tuff
occasional lenses conglome
ate

C=33u / 38v / 100cc
Lag=21 mins / 100spm #1
75spm #2

SAND: medium gray-green to
gray-brown, common varicolo
ed grains, fine to very
coarse, poorly sorted with
green red tan & lavender tu
fragments, common very fine
quartz and mafic minerals,
light green clay matrix wit
occasional kaolinite

SAND: gray-brown cuttings,
poorly consolidated fine to
very coarse poorly sorted,
predominantly tuff fragment
occasional quartz grains wi
volcanic-metamorphic pebble
light green clay matrix in-
terbedded with clatstone,
blocky to platy commonly
cohesive, varicolored proba
ble altered tuff beds



occasional quartz grains with volcanic-metamorphic pebbles, light green clay matrix interbedded with claystone, blocky to platy commonly cohesive, varicolored probable altered tuff beds

2554' 0°30'

w 73 v 37

SAND: dark gray-brown, moderately to poorly consolidated, very fine to fine, moderately well sorted, predominantly varicolored tuff fragments with common subrounded clear to frosted quartz, occasional mafic minerals trace muscovite, dark brown clay, altered tuff matrix

CLAY: light green, very sticky easily hydrated, moderately silty

SAND: light green to white, poorly consolidated, lumpy very fine to medium grained moderately sorted, predominately varicolored lith fragments, abundant common black mafic minerals, light gray green clay matrix

w 72 v 34 f 7.4 fc 1/32
pH 8.9 s 750 sd 1/2%
sol 9%

SAND: light green, poorly co solidated very fine to mediu grained fair sorting, varicolored lith fragments abundant clear quartz angular su rounded, light green clay matrix

2966' 0°30'

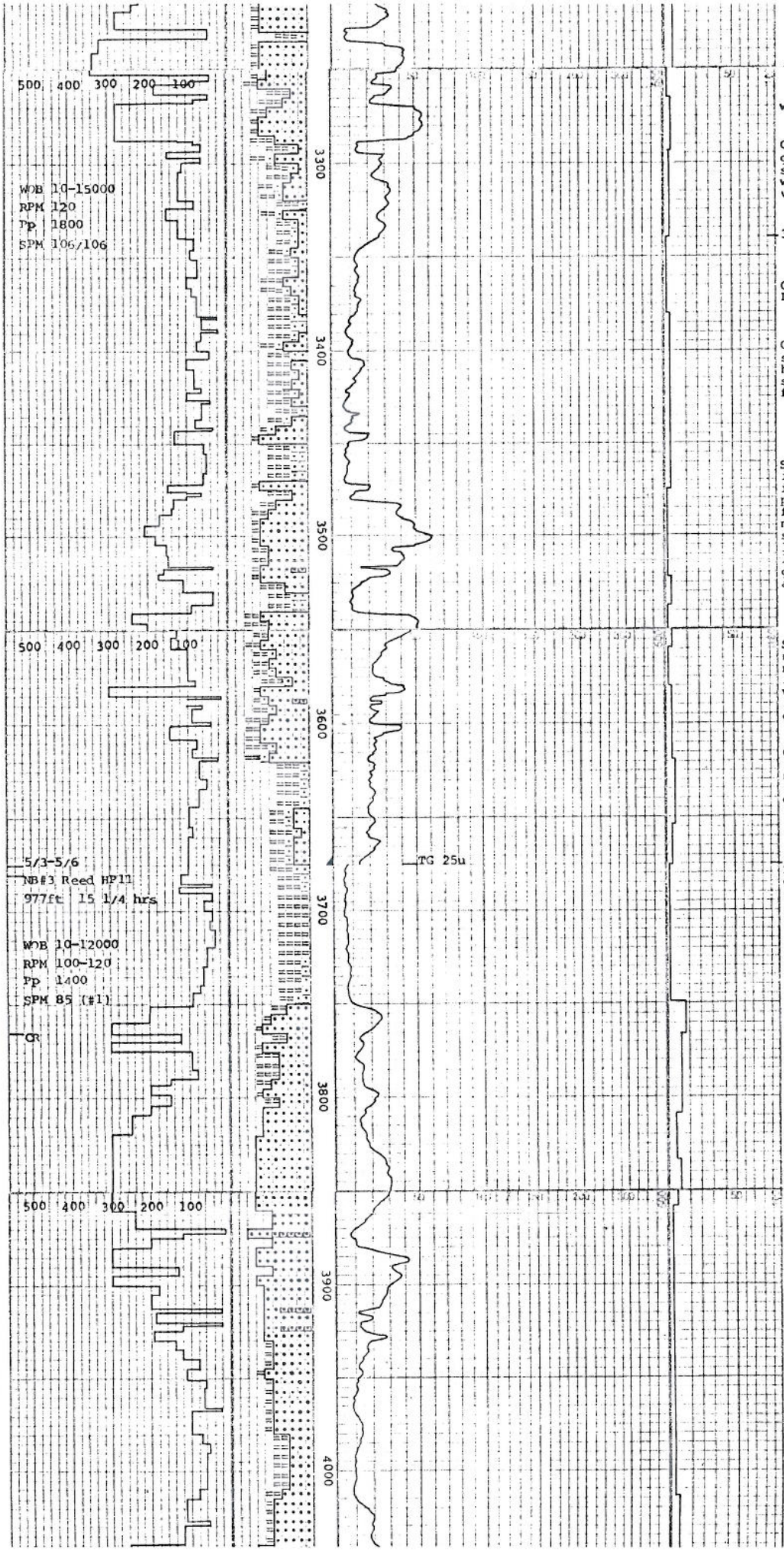
SAND: medium to dark gray, very fine unconsolidated an ular to subrounded predomin ntly clear quartz, minor mi and variegated lith fragmen in medium gray clay matrix

CLAY: medium gray, very sti ky gummy silty, light to da green siltstone soft to fir but brittle

Rm 2.79 Rf 2.71 s 730
T 104

SAND: light to medium gray, very fine fair to well sort silty to fine grained, pre dominantly clear-frosted quartz with minor biotite variegated lithic fragments in light to medium gray cl matrix

w 73 v 37



w 73 v 37

CLAY: medium gray to light green, slightly firm to very sticky gummy, light green white siltstone bentonitic, very sandy

3340' 0°00'

C=45u / 38v / 125cc
Lag=29 mins / 106spm / 1 & 2

CLAY: dark gray-black, very silty soluble with abundant highly variegated varicolore sand grains altered tuff ver fine grained unconsolidated

SAND: dark gray, fine to med ium grained fair to poor sor ing angular to well rounded pebbles, predominantly clear frosted quartz very fine to medium grained subangular to subrounded, common pyrite an lignite fragments occasional ly pyritized, medium to ligh gray clay matrix with good amount of white kaolin

SAND: medium gray, fine to medium grained angular with minor black pebbles, predom- inantly clear-frosted quartz with common pyrite mica and lignite fragments, medium gray to dark brown clay

CLAY: dark gray to dark brow very sticky-gummy, microlig- nitic siltstone very brittle to soft, good trace fine san quartz pyrite mica and lig- nite fragments

3675' 0°15'
Ran Halliburton DIL-CDL-DSN- GR logs; Ran 86 joints of 7 K-55 20# casing to 3674'; Ra Halliburton Cement Bond Log; Drilled out 5' and ran 1500# leak off test

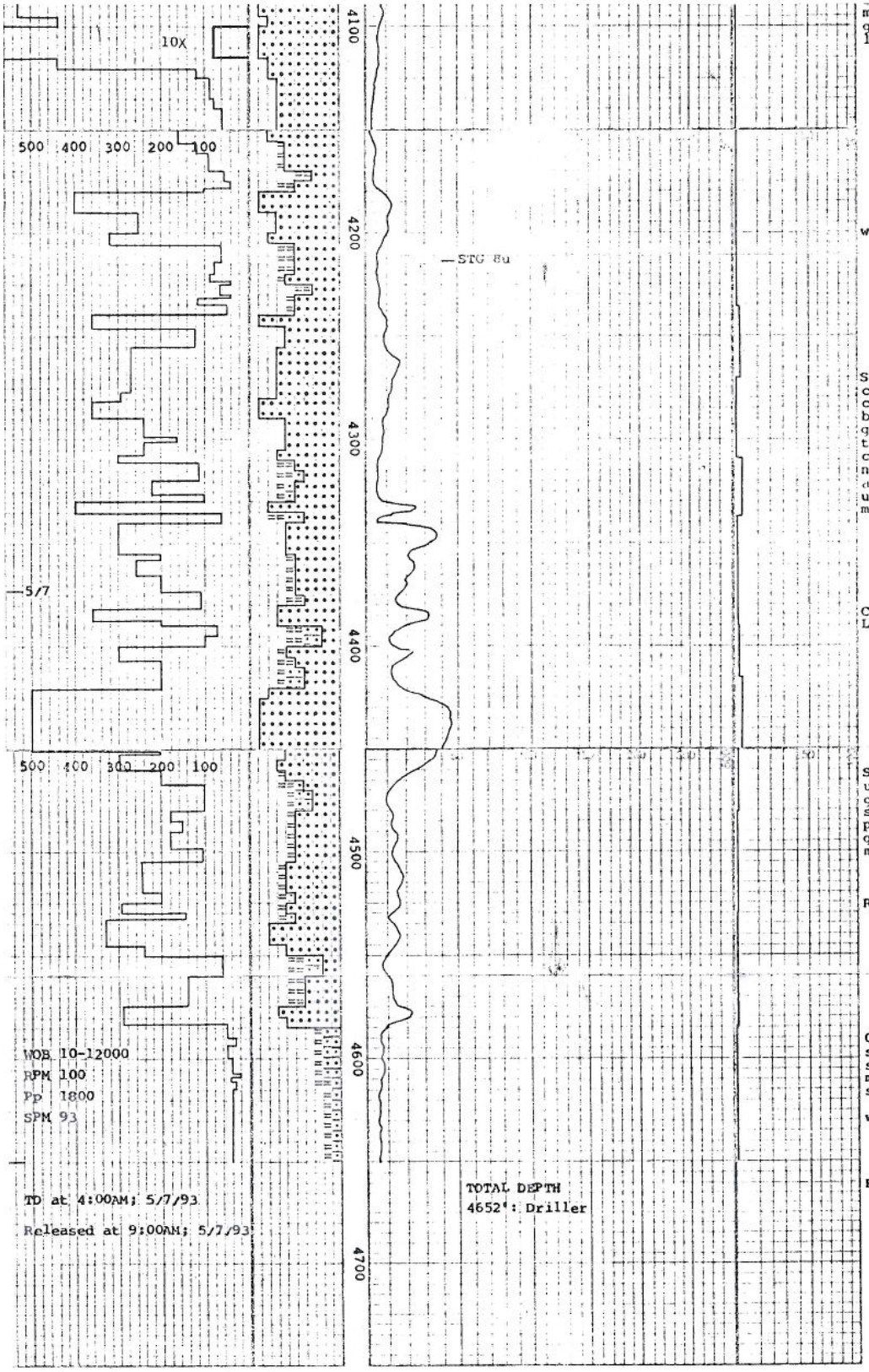
CLAY: dark brown-graybrown, very soluble soft sticky wit fine-medium grained pyrite and pyritized fossil fragmen trace glauconite and lignite

SAND: very fine to very coarse subangular to rounded fair sorting, predominantly clear-frosted quartz in ligh gray-white kaolin matrix, co mon fossil fragments pyrite and glauconite, light gray- brown clay soft soluble stic ky

w 71 v 43 f 5.0 fc 1/32
pH 10.0 s 550 sd 1/4%
sol 9%

SAND: light gray, very fine- medium grained angular-sub rounded predominantly clear- frosted quartz with occasion al thin bedded cemented sand stone beds, good trace pyrit glauconite lignite fragments and fossil fragments, light gray-white kaolin matrix

SAND: very fine-fine grained angular-subangular clear- milky quartz, common varico ored lithic fragments, trac pyrite glauconite lignite a fossil shell fragments, ligh gray and graybrown very sol ble clay



milky quartz, common pyrite glauconite and varicolored lithic fragments

w 70 v 39

SAND: light gray to white, u consolidated with occasional calcareous cemented sandston bed, very fine to coarse grained poorly sorted angula to subangular predominantly clear-milky quartz, minor li nite fragments trace pyrite and mica, light gray very sol uble clay matrix, occasional medium gray friable siltston

C=70u / 42v / 110cc
LAG=32mins / 100spm / #1

SAND: light gray to white, unconsolidated fine to coars grained poorly to moderately sorted angular to subangular, predominantly clear-frosted quartz in light gray clay matrix

Rm 1.9 Rf 2.1 s 800 T 108

CLAY: light to medium gray, soft well hydrated moderatel soluble slightly silty with minor dark gray firm silt-stone

w 71 v 40

Ran Halliburton E-Logs

NORTHERN CALIFORNIA POWER AGENCY "Lodi STIG" No. 1; Sec. 24, T3N-R5E, MDB&M; San Joaquin County, CA

STANDARD LOG (B) 10-0272

FINAL PRINT

HALLIBURTON LOGGING SERVICES, INC.

BOND LOG

MSG NEUTRON COLLAR CBL LOG

5" = 100'

COMP. N.C.P.A.
WELL LODI STIG NO.1
FIELD LODI
COUNTY SAN JOAQUIN ST. CALIF

COMPANY N.C.P.A.
WELL LODI STIG NO.1
FIELD LODI
COUNTY SAN JOAQUIN STATE CALIF.
API NO. 04-077-20567
LOCATION 478 FEET NORTH AND 83 FEET EAST FROM THE SOUTHWEST CORNER OF:
SEC. 24 TWP. 3N RGE. 5E

OTHER SERVICES

PERMANENT DATUM	GROUND LEVEL	ELEV. 6.0	ELEV.: K.B. 20.00
LOG MEASURED FROM	KELLY BUSHING 14.0	FT. ABOVE PERM. DATUM	D.F. -----
DRILLING MEASURED FROM	KELLY BUSHING		G.L. 6.00

DATE @ TIME LOGGED	05/04/93 7:00 PM	TYPE OF FLUID IN HOLE	MUD
RUN NO.	ONE	DENSITY OF FLUID	71.0 CU/FT
DEPTH - DRILLER	3675.00	FLUID LEVEL	FULL
DEPTH - LOGGER	3598.00	CEMENT TOP EST. - LOGGED	SURF.
BTM. LOGGED INTERVAL	3586.00	EQUIPMENT : LOCATION	50533 WDLD.
TOP LOGGED INTERVAL	450.00	RECORDED BY	JOHN GUNBY
MAX TEMP. DEGREE	NOT RECORDED	WITNESSED BY	MR. D BROWN

CEMENTING DATA	SEE REMARKS	PROTECTION STRING	PRODUCTION STRING	LINER
DATE/TIME CEMENTED				
PRIMARY/SQUEEZE				
EXPECTED				
COMP. STRENGTH				
CEMENT VOLUME				
CEMENT TYPE/WEIGHT				
FORMULATION				
MUD TYPE/MUD WEIGHT				

RUN NO.	BIT	BOREHOLE RECORD FROM	BOREHOLE RECORD TO	CASING AND TUBING RECORD SIZE	WGT.	FROM	TO
ONE	9.875	614.00	3670.00	10.75		614.00	SURF.
				7.00	20.00	3675.00	SURF.

FOLD HERE

PGM VERSION: H L S DLS HD 1.0

SERVICE TICKET NO.: 805963 API SERIAL NO.: 04-077-20567

THE WELL NAME, LOCATION, CEMENTING DATA AND BOREHOLE DESCRIPTION FURNISHED BY CLIENT

CEMENTING DATA

CEMENT PUMPED	SEE REMARKS	@		/ JOINT FROM	TO
PRECEDING FLUID		VOLUME	BBL	CENTRALIZERS / JOINT FROM	TO
RETURNS	FULL	PARTIAL	NONE	/ JOINT FROM	TO
PIPE ROTATED/RECIPROCATED	DURING PUMPING		YES NO	/ JOINT FROM	TO
	AFTER PLUG DOWN		YES NO	CENTRALIZERS / JOINT FROM	TO
PLUG PUMPED				/ JOINT FROM	TO
PLUG LANDING PRESSURE:			HRS AFTER PUMPING		
PRESSURE HELD					

EQUIPMENT DATA

GAMMA		NEUTRON		ACOUSTIC	
RUN NO.		RUN NO.	ONE	RUN NO.	ONE
SERIAL NO.		SERIAL NO.	102572	SERIAL NO.	107009
MODEL NO.		MODEL NO.	W-265	MODEL NO.	W-271
DIAMETER		DIAMETER	3.375	NO. OF CENT	FOUR
DETECTOR MODEL NO.		LOG TYPE	CBL/N	SPACING	3 AND 5 FEET
TYPE		SOURCE TYPE	AMBE 241		
LENGTH		SERIAL NO.	61		
DISTANCE TO SOURCE		STRENGTH	18.5 CURIES		

LOGGING DATA

GENERAL RUN NO.	DEPTHS FROM	DEPTHS TO	WELL HEAD PRESSURE	SPEED FT./MIN.	GAMMA SCALE L	GAMMA SCALE R	NEUTRON SCALE L	NEUTRON SCALE R	ACOUSTIC SCALE L	ACOUSTIC SCALE R
ONE	3586.00	450.00	0	50						

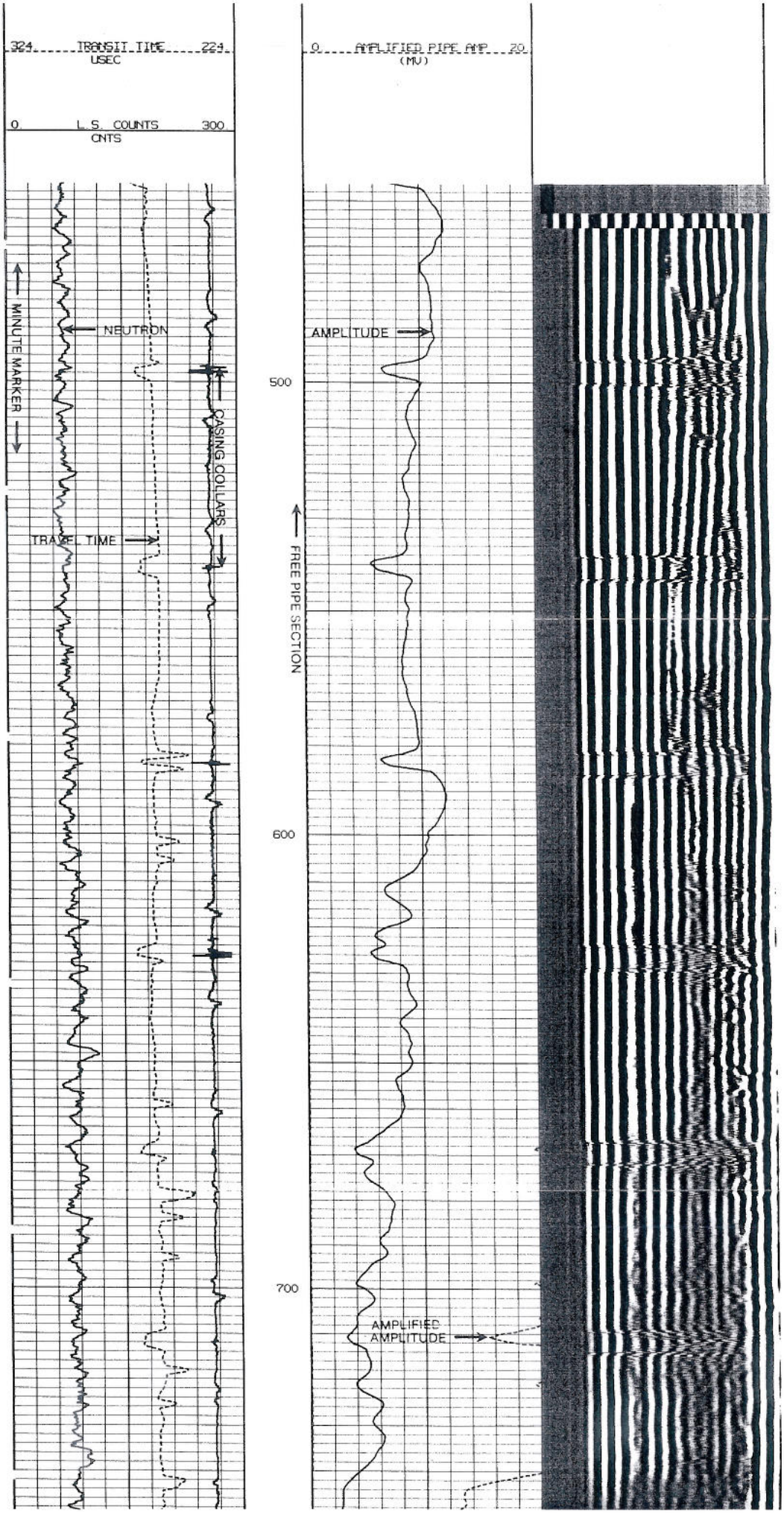
REMARKS: CEMENT DATA: LEAD WAS B.J. LITE CEMENT. 65 PCT LITE. 35 PCT FLY ASH. 6 PCT GEL AND 2 PCT CACL2. TAIL SLURRY. 171 CUFT. "G" WITH 1 PCT CACL2. C.I.P. 05/03/93 AT 7:40 PM.

HALLIBURTON LOGGING SERVICES, INC. DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF LOG DATA. CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HLS PERSONNEL OR WHICH MAY APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS OR RECOMMENDATIONS AGREES THAT HLS IS NOT RESPONSIBLE, EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILFUL MISCONDUCT FOR ANY LOSS, DAMAGES OR EXPENSES RESULTING FROM THE USE THEREOF.

N.C.P.A.
LODI STIG NO. 1

10.75 614 TO SURF.

7.0 20# 3675.00 TO SURF.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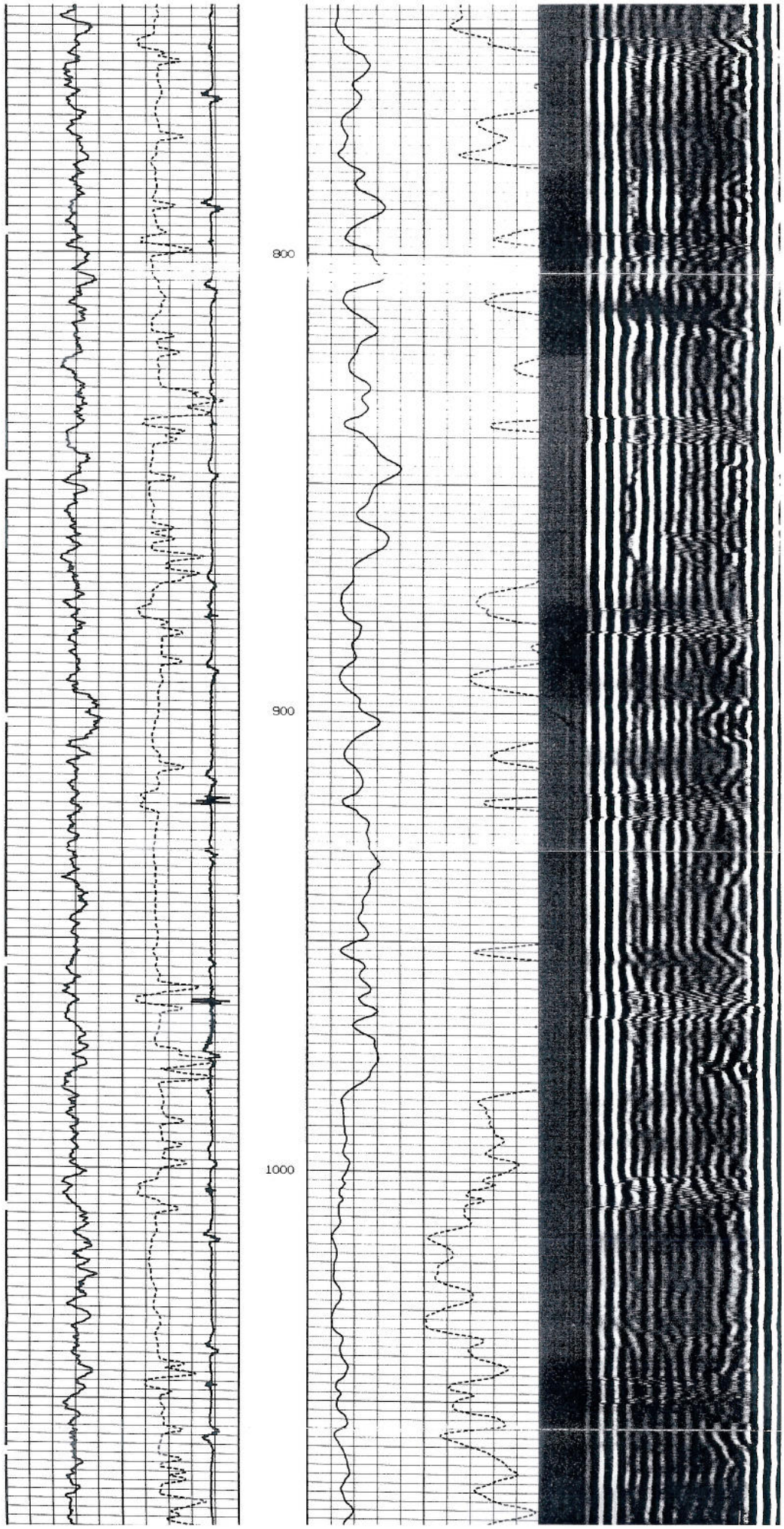
TRANSIT TIME
USEC
224
0
L.S. COUNTS
CNTS
300
MINUTE MARKER
NEUTRON
CASING COLLARS
TRAVEL TIME
0
AMPLIFIED PIPE AMP
(MV)
20
AMPLITUDE
500
FREE PIPE SECTION
600
700
AMPLIFIED
AMPLITUDE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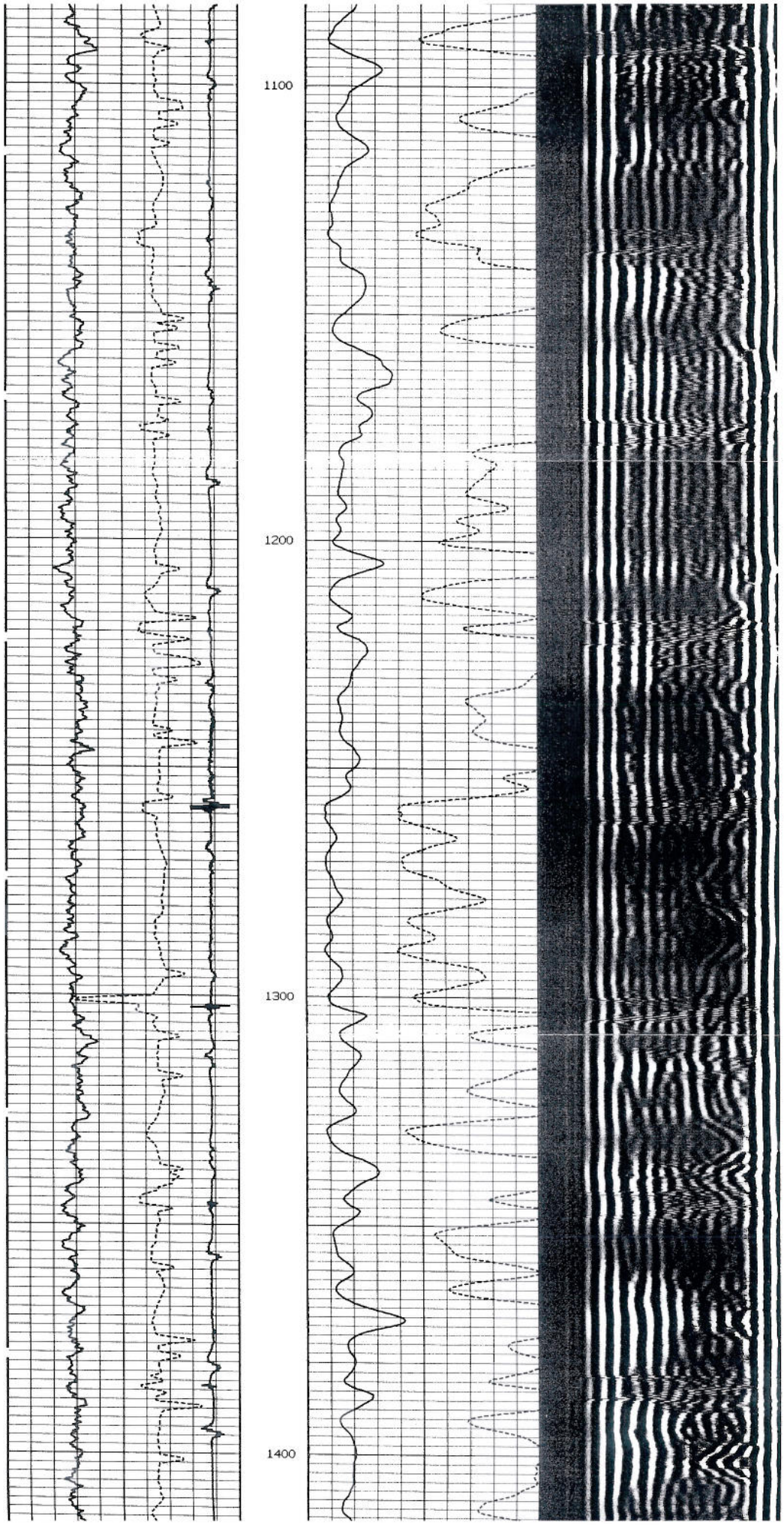
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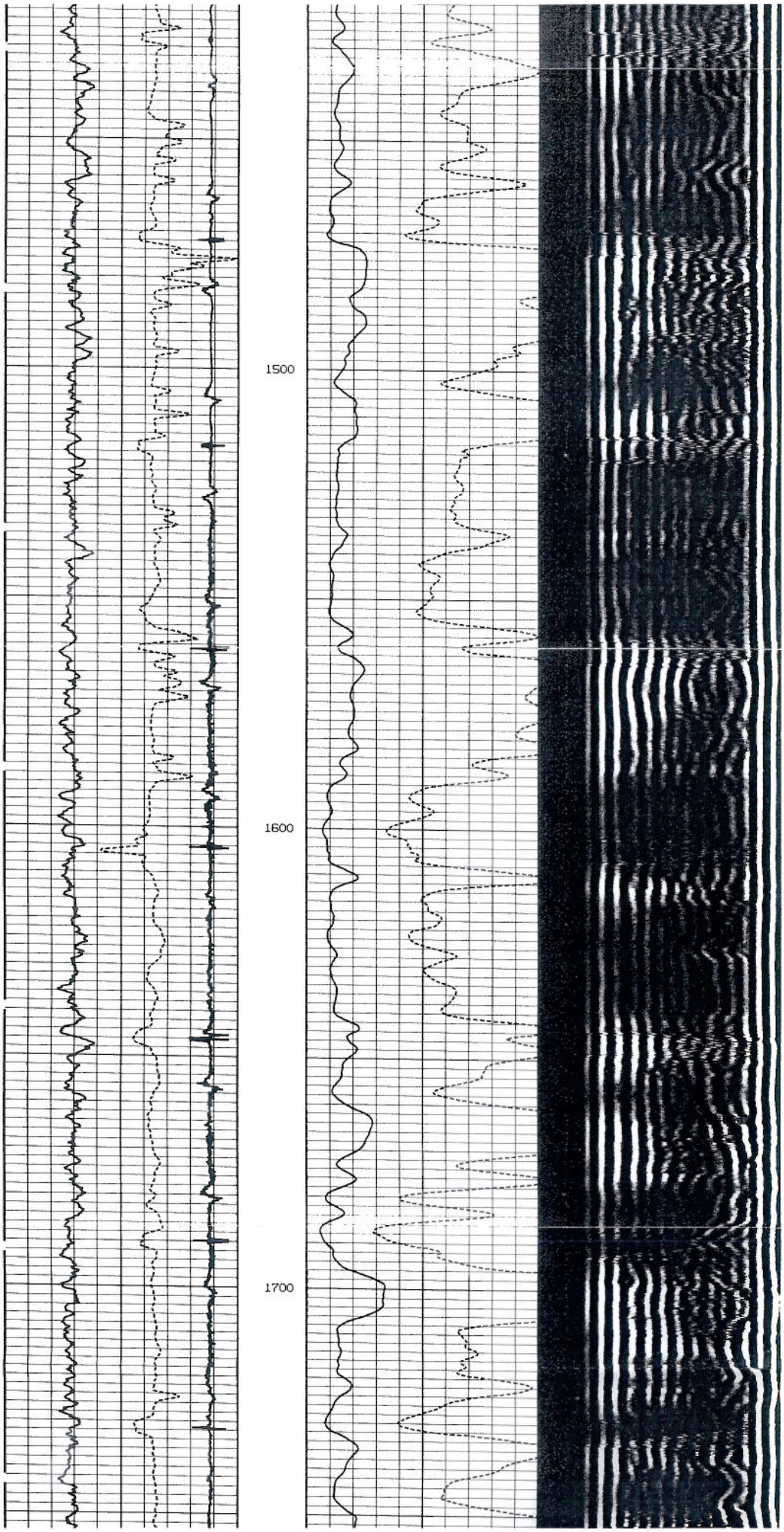
1400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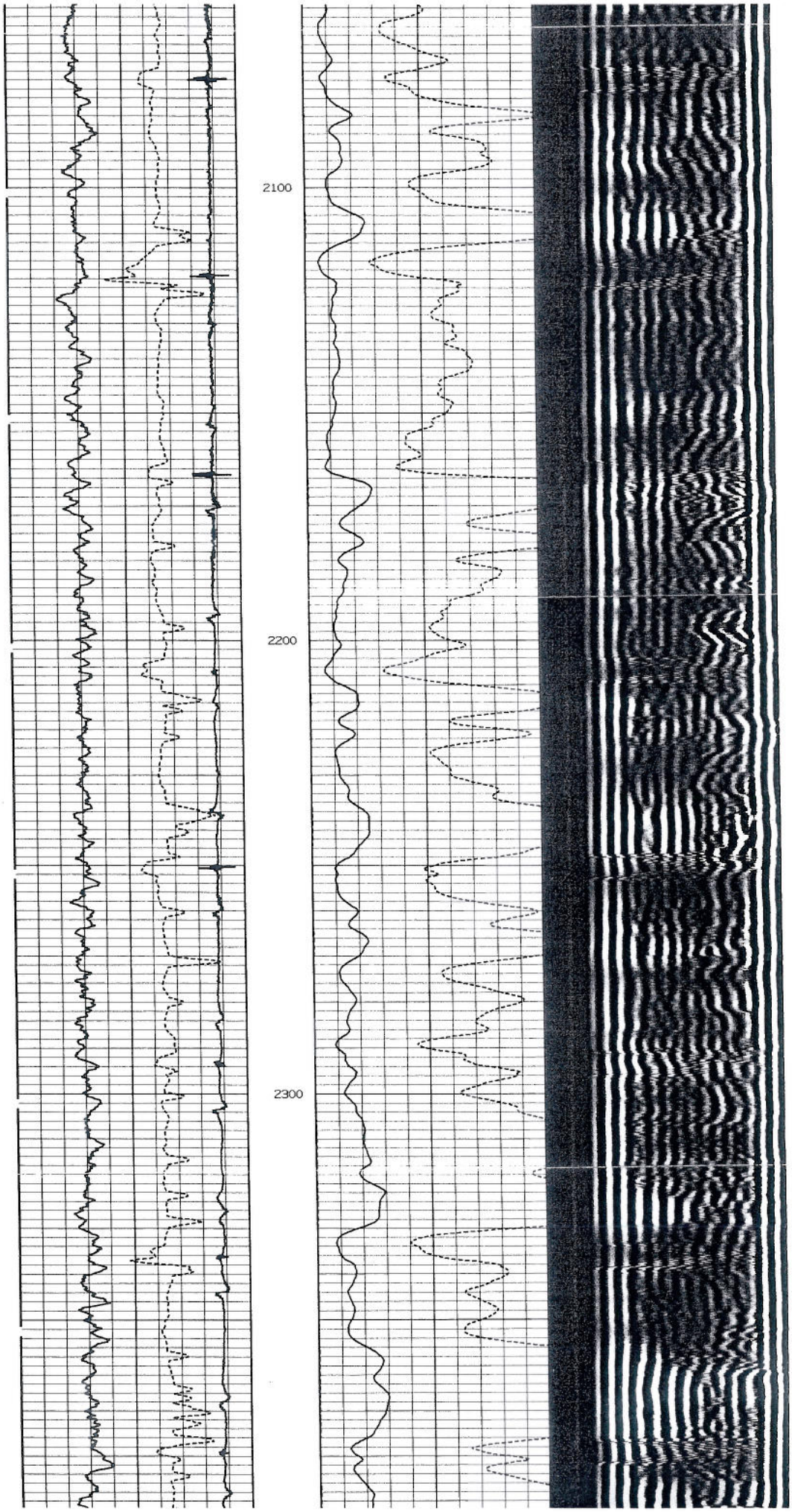
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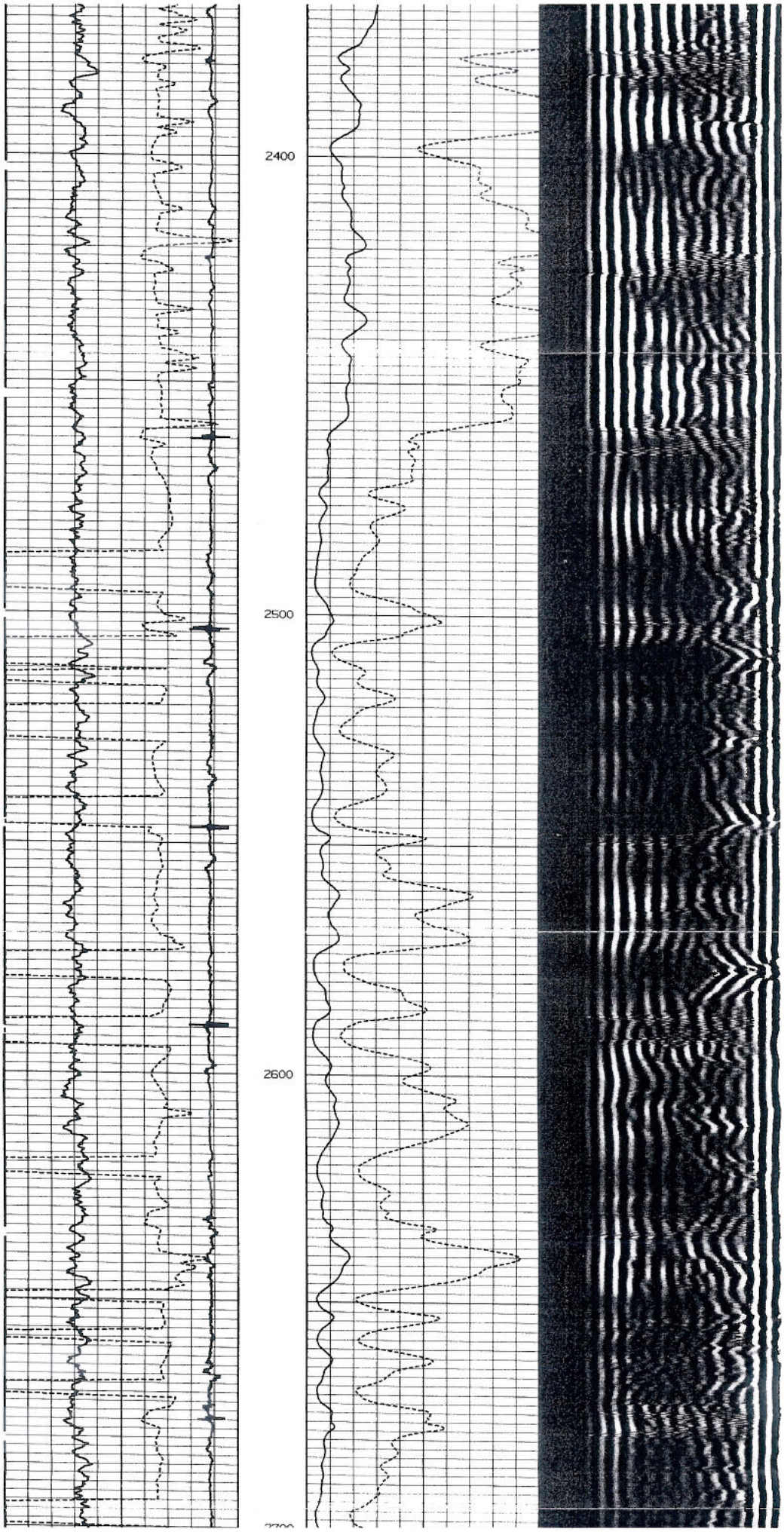
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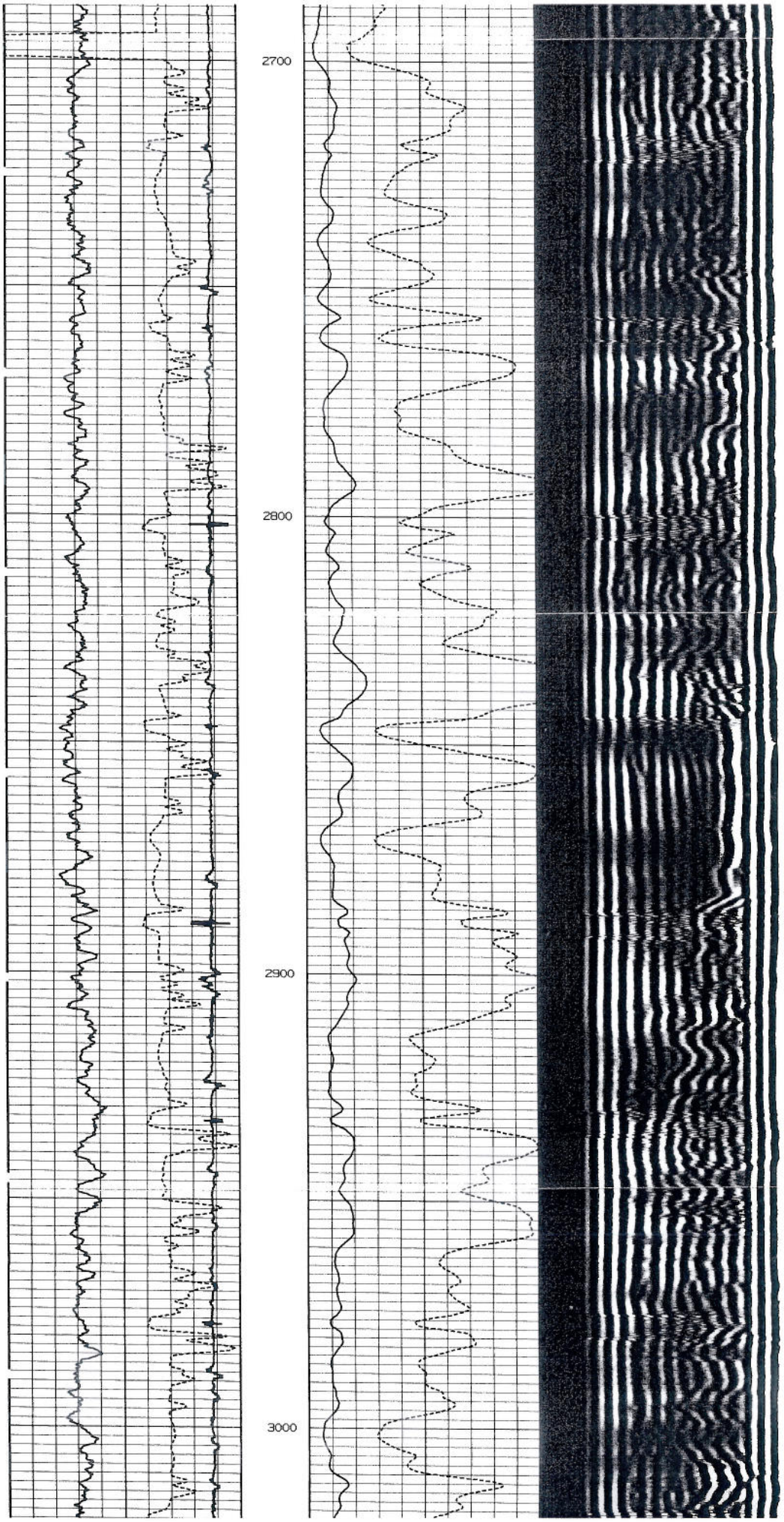
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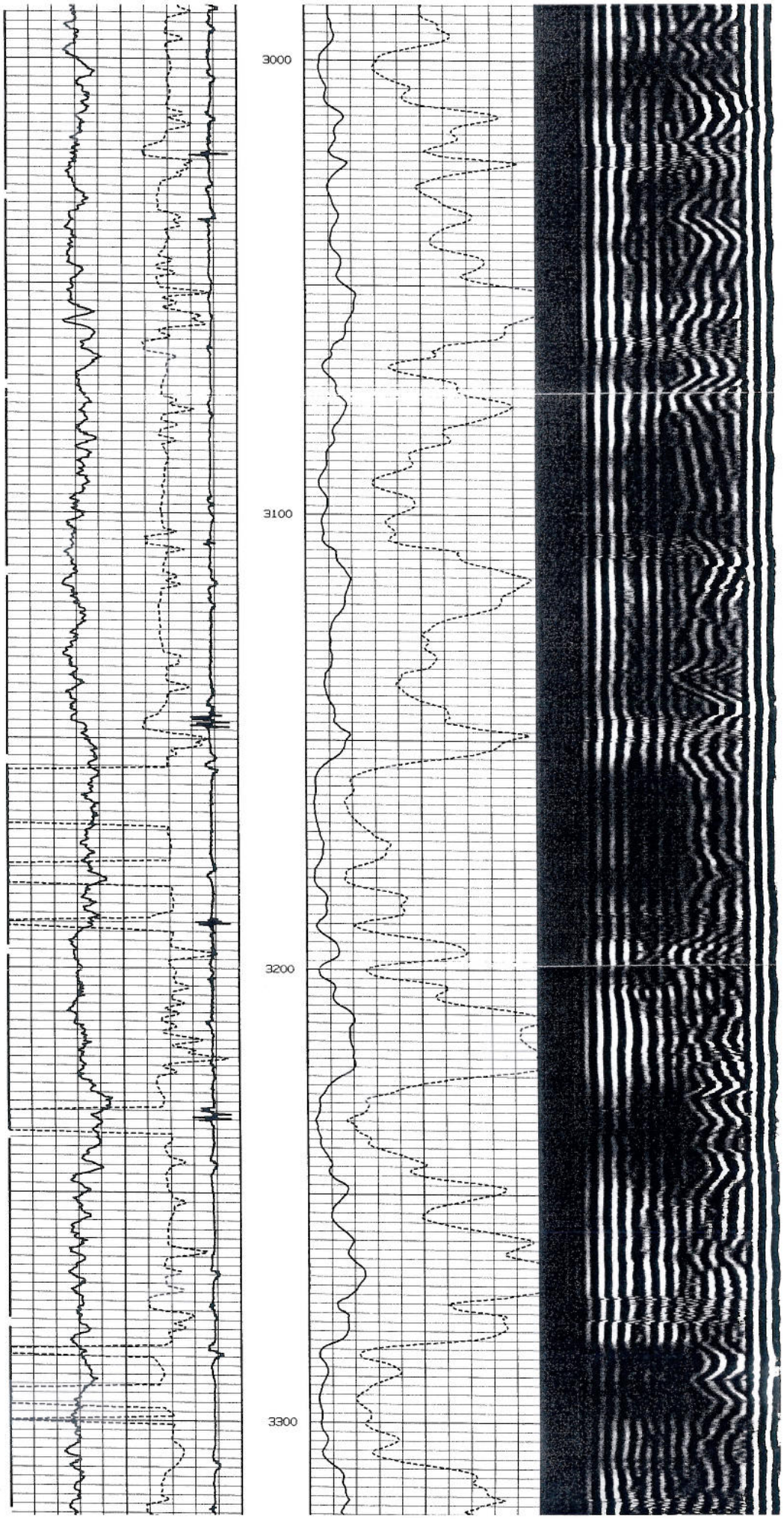
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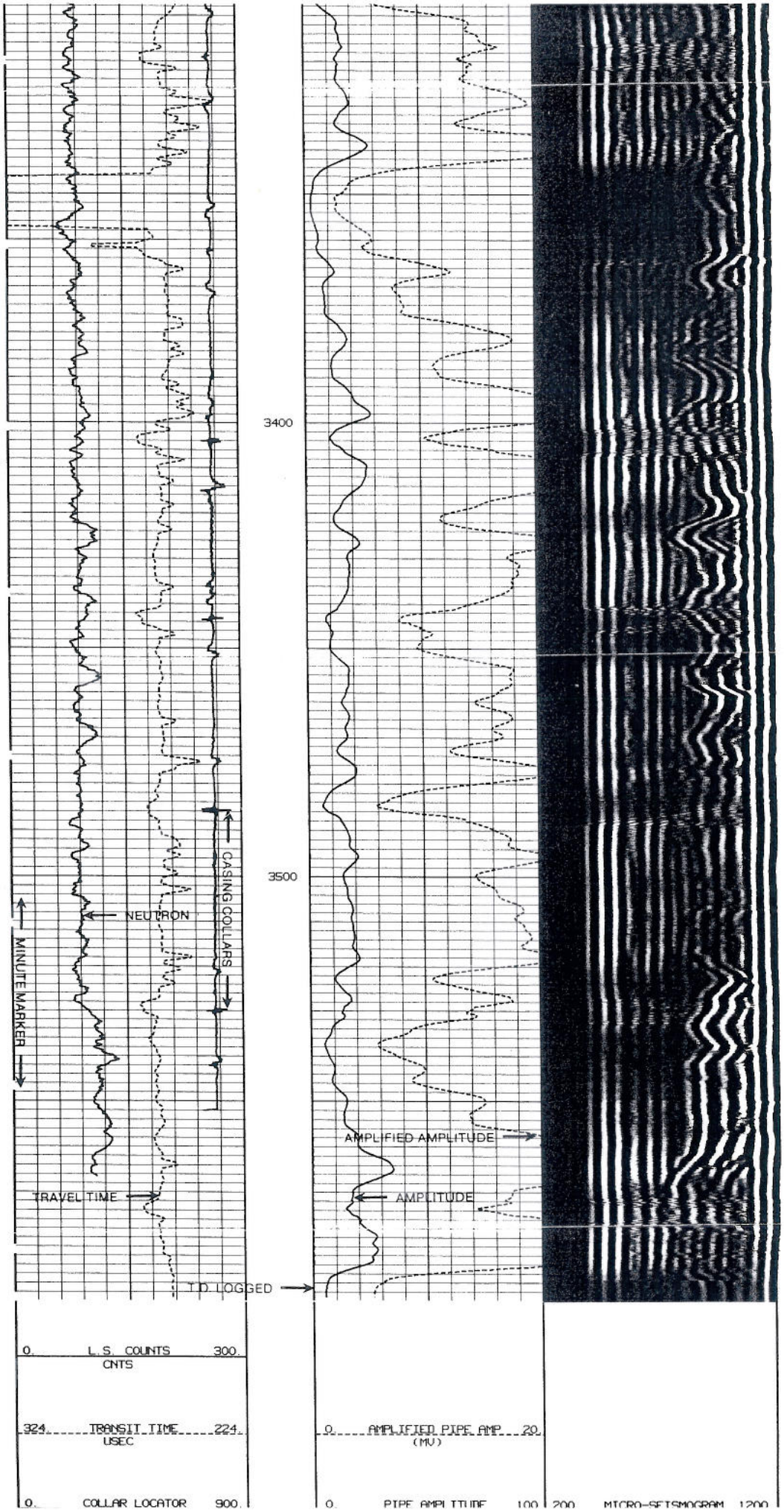
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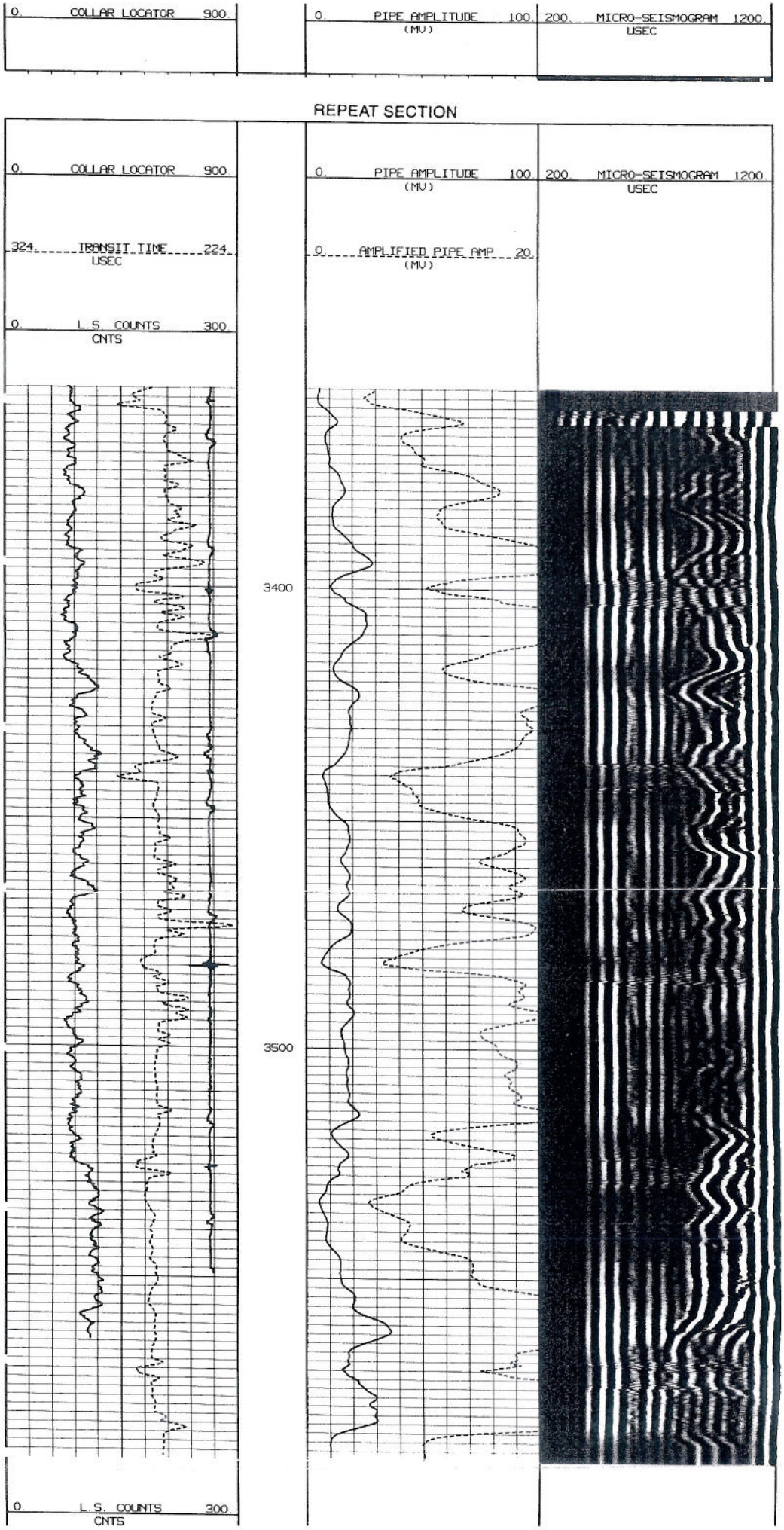
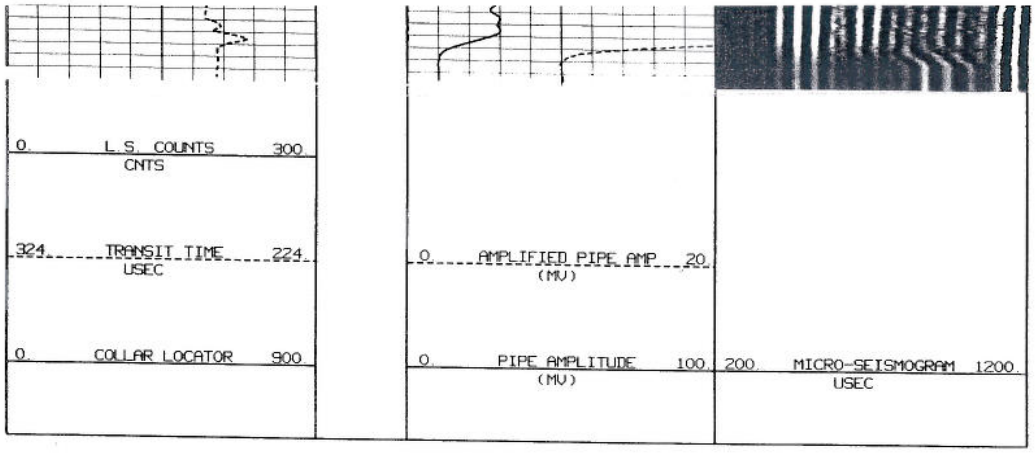
3500
CASING COLLARS
NEUTRON
MINUTE MARKER
TRAVEL TIME
AMPLIFIED AMPLITUDE
AMPLITUDE
T.D. LOGGED
0. L.S. COUNTS 300.
CNTS
324. TRANSIT TIME 224.
USEC
0. COLLAR LOCATOR 900.
0. AMPLIFIED PIPE AMP. 20.
(MV)
0. PIPE AMPLITUDE 100
200 MICRO-SEISMOGRAM 1200


0. COLLAR LOCATOR 900.
0. PIPE AMPLITUDE 100.
(MV)
200. MICRO-SEISMOGRAM 1200.
USEC
REPEAT SECTION
0. COLLAR LOCATOR 900.
0. PIPE AMPLITUDE 100.
(MV)
200. MICRO-SEISMOGRAM 1200.
USEC
324. TRANSIT TIME 224.
USEC
0. AMPLIFIED PIPE AMP. 20.
(MV)
0. L.S. COUNTS 300.
CNTS
3400
3500
0. L.S. COUNTS 300.
CNTS



WELL LOCATION : LODI

WELL NAME : LODI STIG NO. 1

ENG H L S DLS CH V4.35 LIS 10/14/92

LOG TAPE ID 39007001

DATE 05/04/93

ENG H L S DLS CH V4.35 LIS 10/14/92
PARAMETER TABLE

TDRV	TNUM	RATE	TOOL	AZER	DSNR	3->6
OFF	1.	20.	271	18.	14.	NO
THS1	THS2	DIST	PID	TOD	KT	KSLS
0.	0.	2.	6.241	3.385	1.	0.9804
TRIG	MSGR	VIEW	SWCH	GRDM		
POS	AF	AN	13.	OFF		
MNEU	SO	CWGT	ASKY			
CSAN	0.	20.	NO			
BS	CSIZ	TELE	LIS	DLY	DIR	PLOT
9.875	7.	YES	NO	YES	UP	FULL

ENG H L S DLS CH V4.35 LIS 10/14/92
PLOT TABLE

CAM1			VER			CAM2		
SCALE	ANNOTATION		SCALE	ANNOTATION		SCALE	ANNOTATION	
240	100		0	100		240	100	
TRK1	TRK2	TRK3	TRK1	TRK2	TRK3	TRK1	TRK2	TRK3
LIN	LIN	LIN	LIN	LIN	LIN	LIN	LIN	LIN

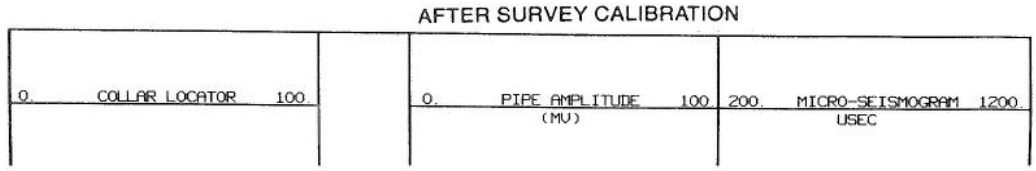
ENG H L S DLS CH V4.35 LIS 10/14/92

SERVICE ID	TRK	UNIT	SCL L	SCL R	RBASE L	RBASE R	TYPE	STYP	OPFL	IPFL	OFF	LIS	CVCT 1	CVCT 2L
TEMP 1	1	DEG	100.	200.	Y	Y	0	LIN	0.	0.	0.	Y	QNN1	
DTEM 12	1	DEG	-5.	5.	1	0	0	LIN	0.	0.	0.	Y	QNN	
ATEM 0	1	DEG	0.	40.	1	Y	0	LIN	0.	0.	0.	Y	NNN	
CCL 5	1		0.	100.	Y	Y	0	LIN	0.	0.	0.	Y	YNY2	
CCLU 6	1		0.	10.	Y	Y	0	LIN	0.	0.	0.	Y	QNN	
AMPP 7	2	(MV)	0.	100.	0	0	0	LIN	0.	1.25	0.	Y	YNY3	
APAM 3	2	(MV)	0.	20.	0	0	0	LIN	0.	0	0.	Y	FNF	
MSG 4	3	USEC	200.	1200.	0	0	0	LIN	0.	0.	0.	N	YNY	
TT 8	1	USEC	324.	224.	0	0	0	LIN	0.75	1.25	0.	Y	FNF4	
GR-D 2	1	API	0	150.	Y	Y	0	LIN	1.25	1.75	0.	Y	QNN	
FDSN 9	1	CNTS	0.	1000.	Y	Y	0	LIN	0.	1.75	0.	Y	YNY5	
NDSN 10	2	CNTS	13000.	53000.	Y	Y	0	LIN	0.	3.25	0.	Y	QNN	
NRAT 15	2		200.	0.	Y	Y	0	LIN	1.25	0.	0.	Y	QNN	
NPHI 11	2	%	45.	-15.	1	0	0	LIN	1.25	0.	0.	Y	QNN	

ENG H L S DLS CH V4.35 LIS 10/14/92
TOOL TABLE

SUB	SERIAL #	MODEL	SOURCE #	CALB #	NRM1	INT1	NRM2	INT2	DLY	TCH
TEMP	109	23	0	0	0.025	0	0.	0	0.	4
GR-D	102572	265	0	0	0.3345	0	0.	0	38.75	17
CCL	102572	265	0	0	0.0125	0	0.	0	41.	7
AMPP	107809	271	0	0	-0.0276	4061	5.	0	0.	24
TT	107809	271	0	0	254.	0	0.	0	0.	20
FDSN	102572	265	0	0	0.9757	0	0.	0	26.71	16
NDSN	102572	265	0	0	7.7408	0	0.	0	24.84	15
GP1	0	0	0	0	0.	0	0.	0	0.	0
GP2	0	0	0	0	0.	0	0.	0	0.	0

AFTER SURVEY CALIBRATION



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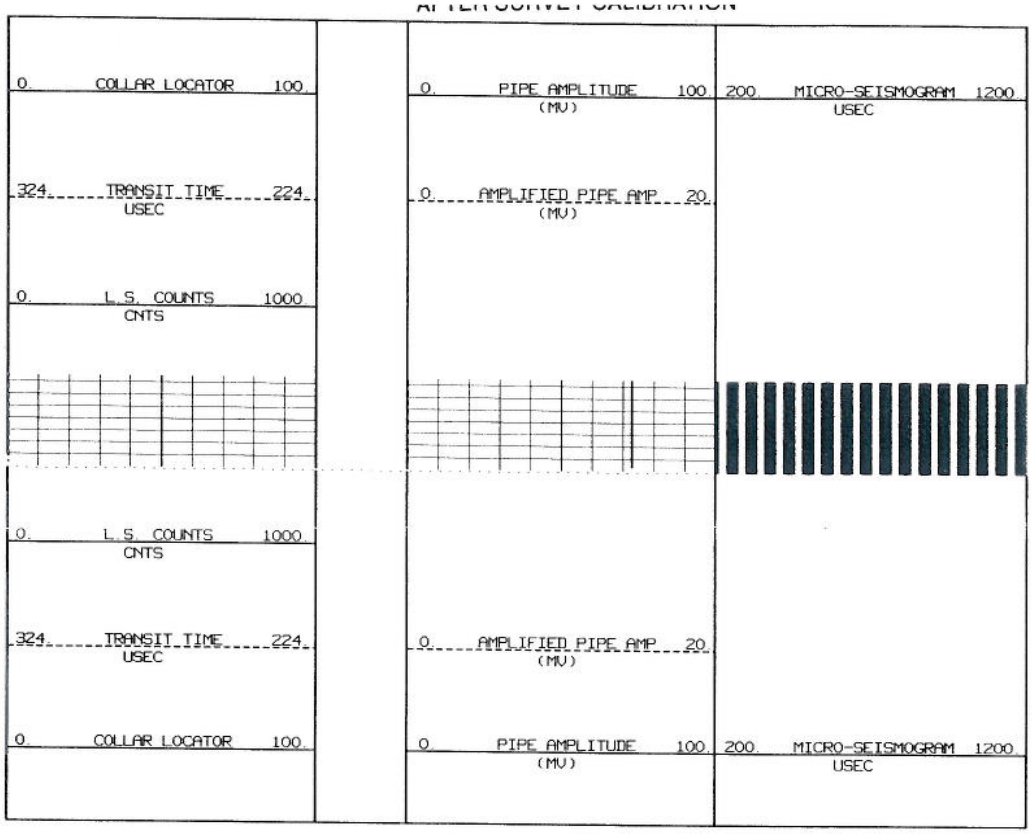

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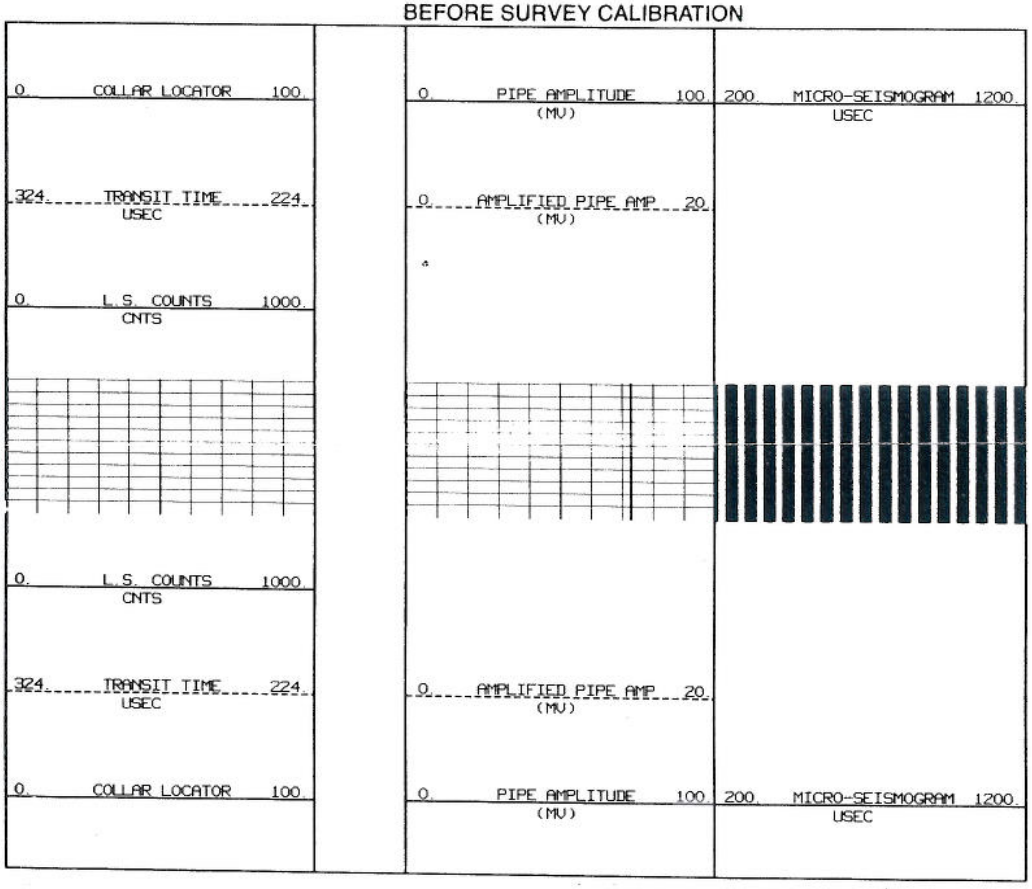
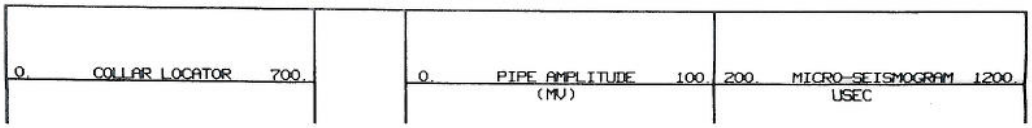
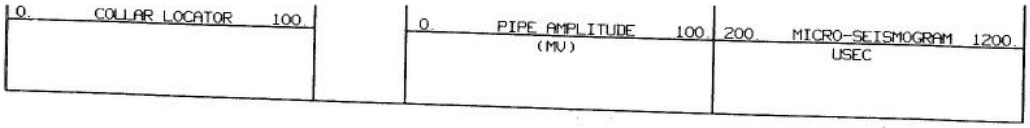


SHOP CALIBRATION

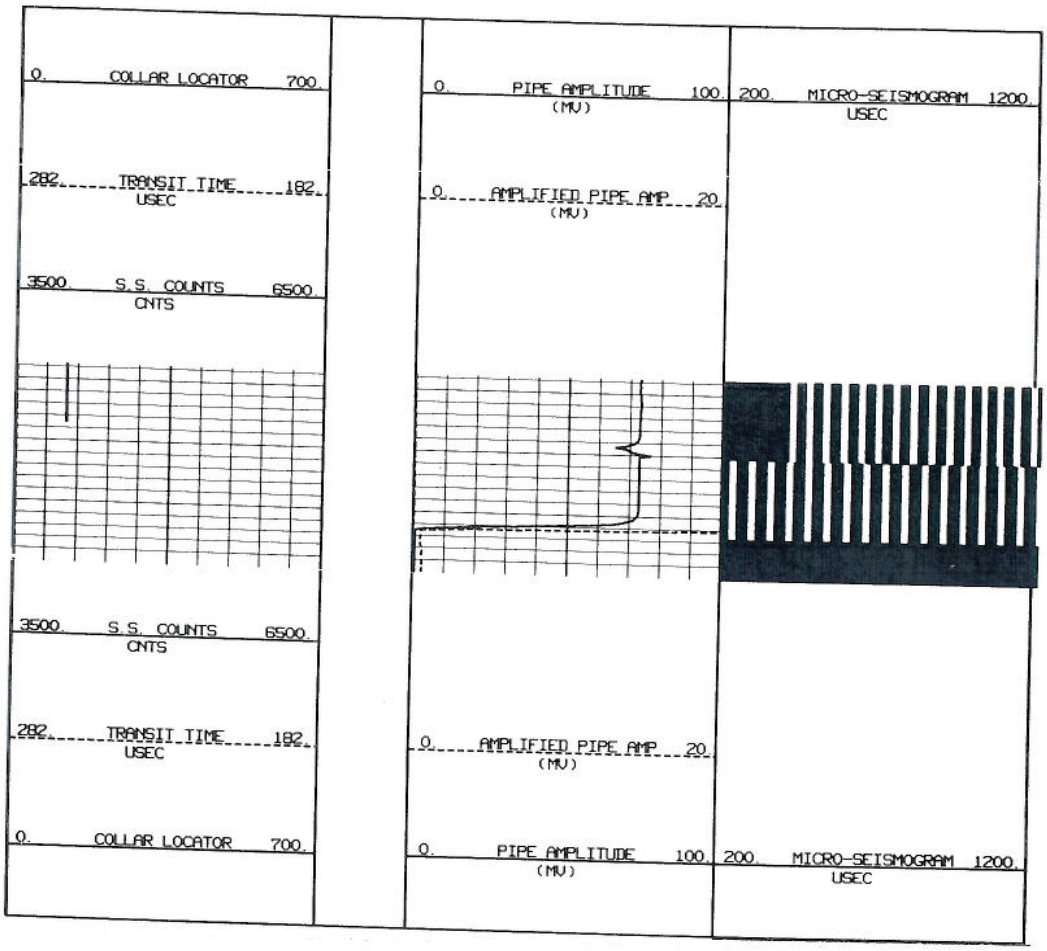
PIPE AMPLTUDE SHOP CALIBRATION
TOOL NUMBER 107809 MOD.W-271
DONE ON 04/12/93 IN 5.5 CASING





SHOP CALIBRATION

PIPE AMPLITUDE SHOP CALIBRATION
TOOL NUMBER 107809 MOD.W-271
DONE ON 04/12/93 IN 5.5 CASING



FLO-LOG INC.

NOISE SURVEY

COMPANY N.C.P.A. FIELD WHITE SLOUGH WELL NAME & NO. STIG #1

SURVEY DATA		WELLBORE DATA					
DATE OF SURVEY	6-8-93	CASING AND TUBING RECORD					
WELL STATUS	WATER DISPOSAL	SIZE	WEIGHT	FROM	TO	PRESSURE	FLUID LEVEL
TYPE OF FLUID	WATER	7"	20#	0'	3660'		
FLUID RATE (S)	SHUT-IN	5"	15#	3358'	4645'		
EFFECTIVE DEPTH	4567'	2-3/8"		4155'	4567'		
LOGGER'S DEPTH (PICKUP)	4567'						
AMOUNT OF FILL	0'						
LOG WITNESSED BY	C.FISHER	PACKER (S) NONE			MANDREL (S) NONE		
LOG RECORDED BY	TULUMELLO	PERFORATIONS 4234'-4573' @ INTERVALS, 4187'-4574' SLOTTED					
REASON FOR SURVEY	FIRST SURVEY ON THIS NEW DISPOSAL WELL.						

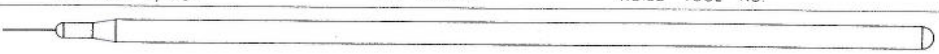
RESULTS AND REMARKS:

NOISE LOG DID NOT SHOW MIGRATION OR LEAKAGE FROM THIS WELL.

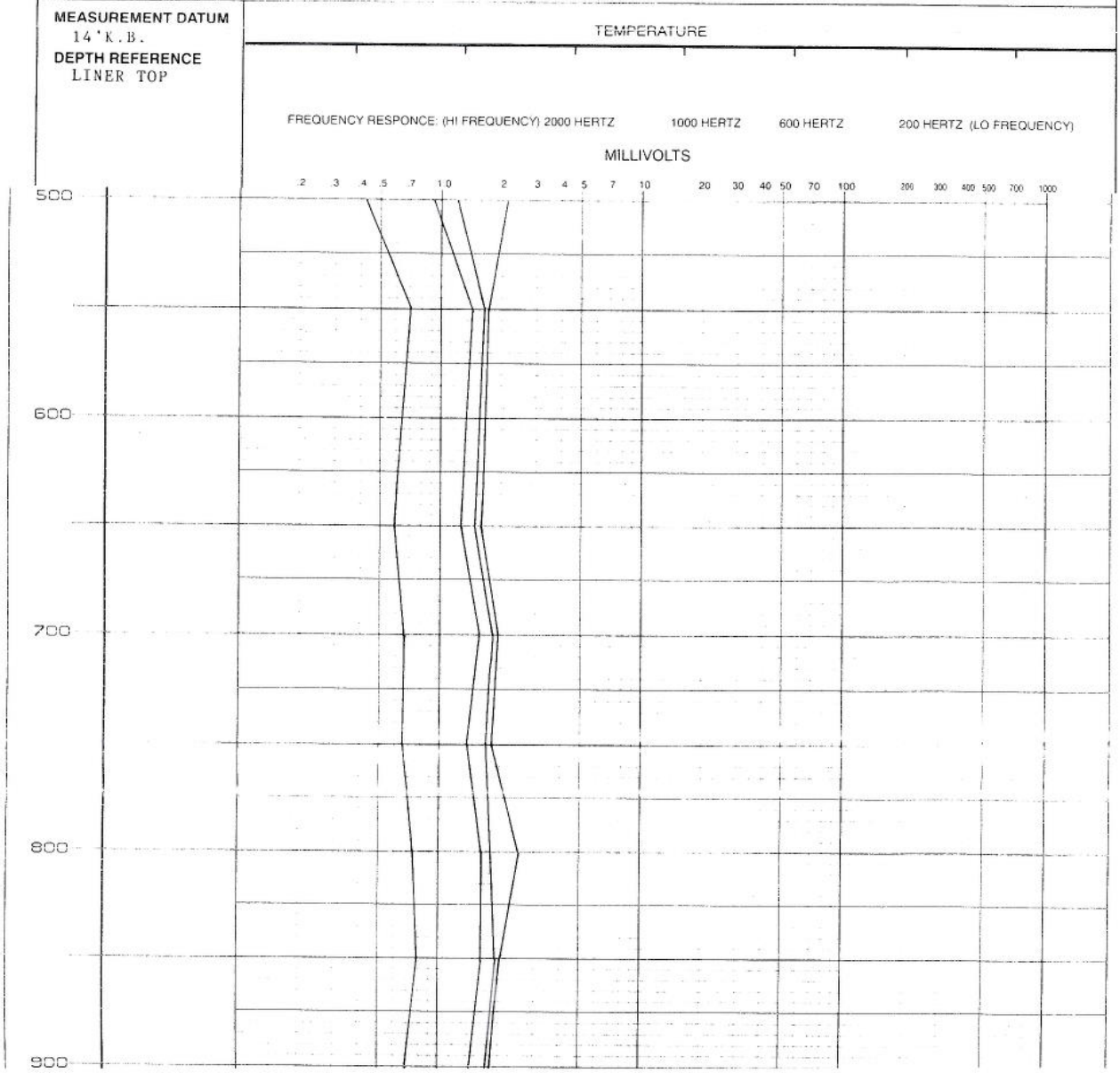
LOGGING UNIT LINE SIZE 3/16" LINE LENGTH NOISE TOOL NO.

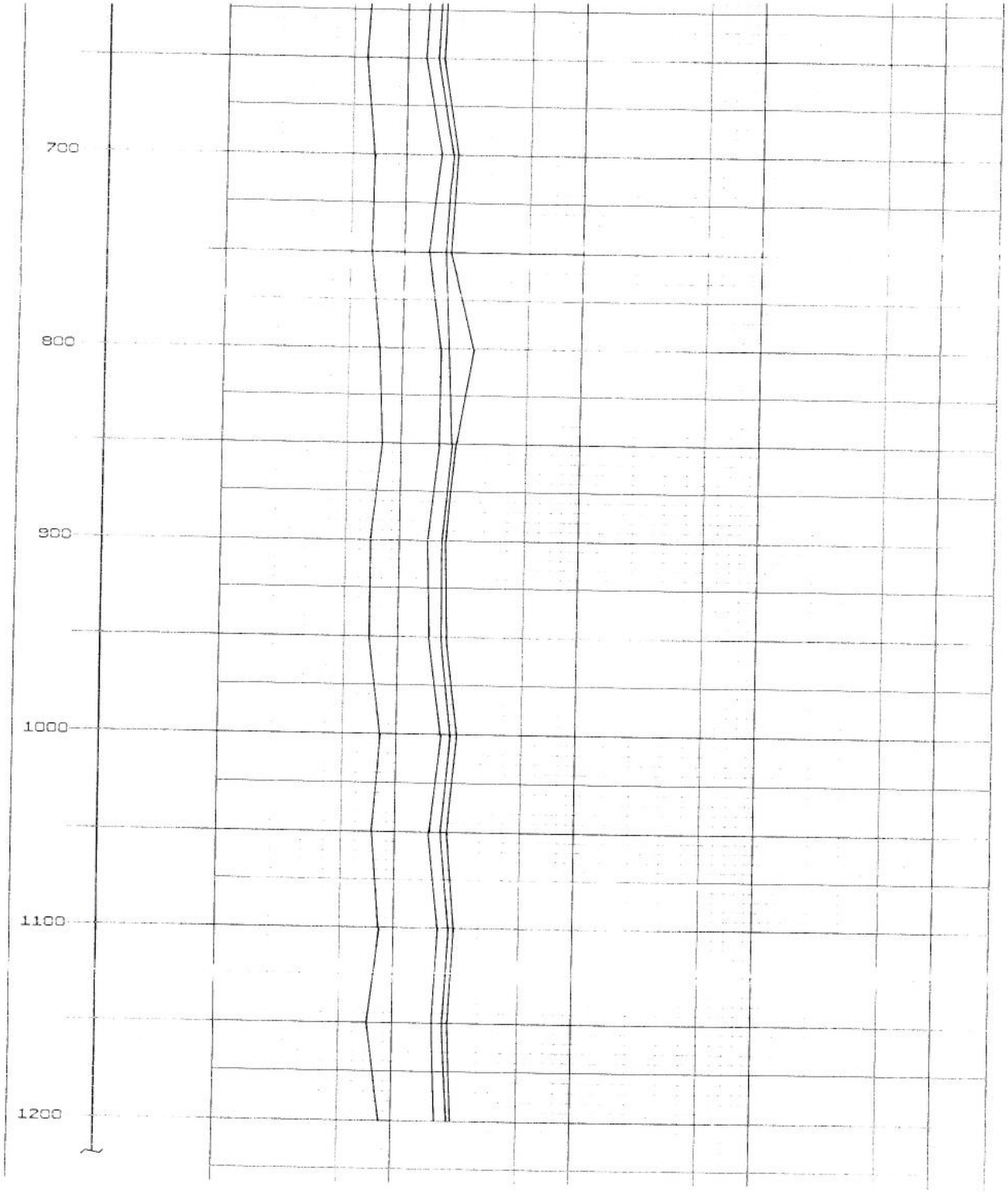
DIAGRAM OF TOOLS USED:

DIAMETER OF TOOLS 1-3/8"



MEASUREMENT DATUM
14'K.B.
DEPTH REFERENCE
LINER TOP




700
800
900
1000
1100
1200

PRIME PERFORATING

FILING NO.

COMPANY NORTHERN CALIF. POWER AGENCY

WELL LODI STIG #1

FIELD WHITE SLOUGH

COUNTY SAN JOAQUIN STATE CA

LOCATION:

SEC. 24 TWP. 3N RGE. 5E

OTHER SERVICES:

PERMANENT DATUM: 20' K.B. ELEV. 6'

LOG MEASURED FROM _____ FT. ABOVE PERM. DATUM

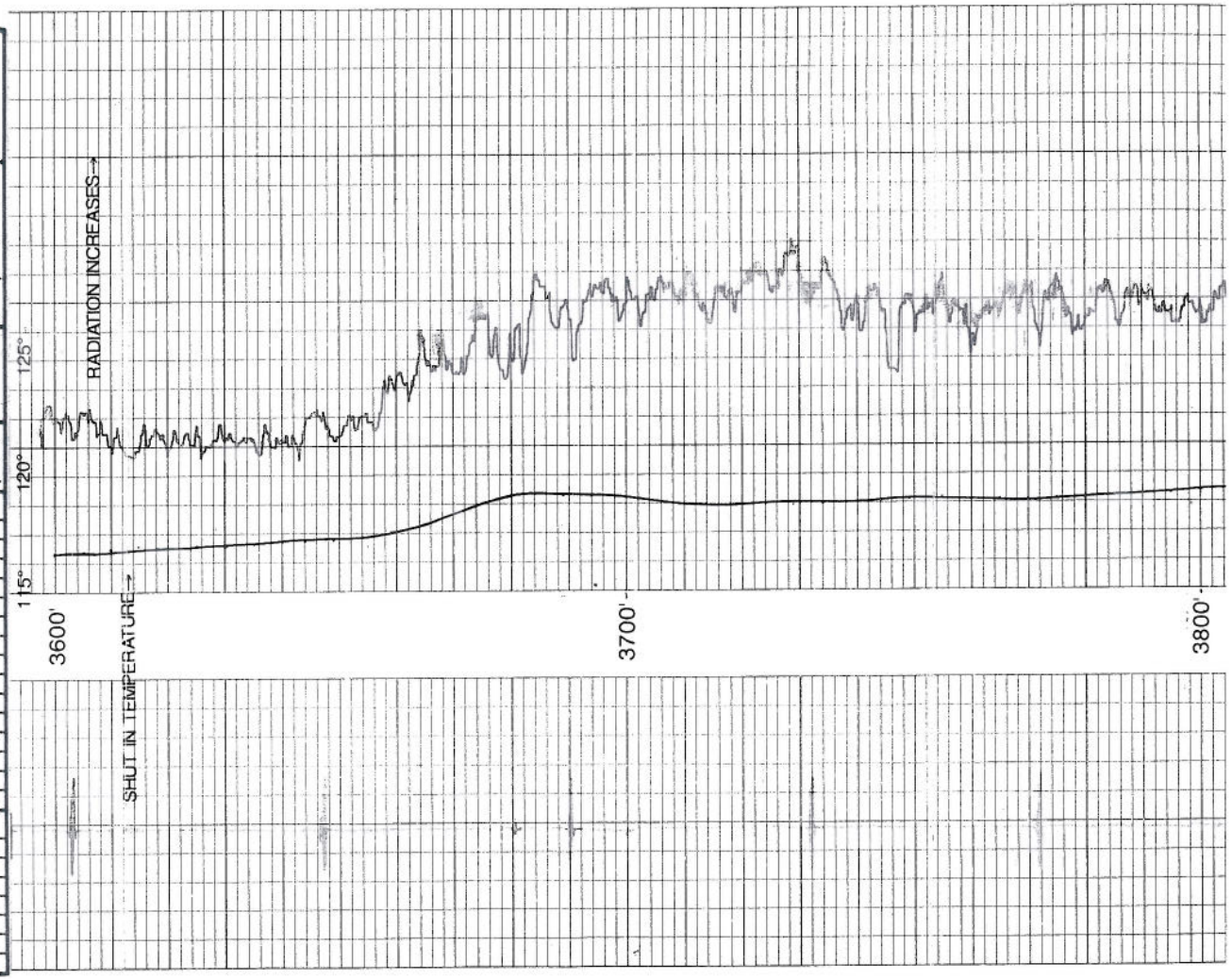
DRILLING MEASURED FROM _____

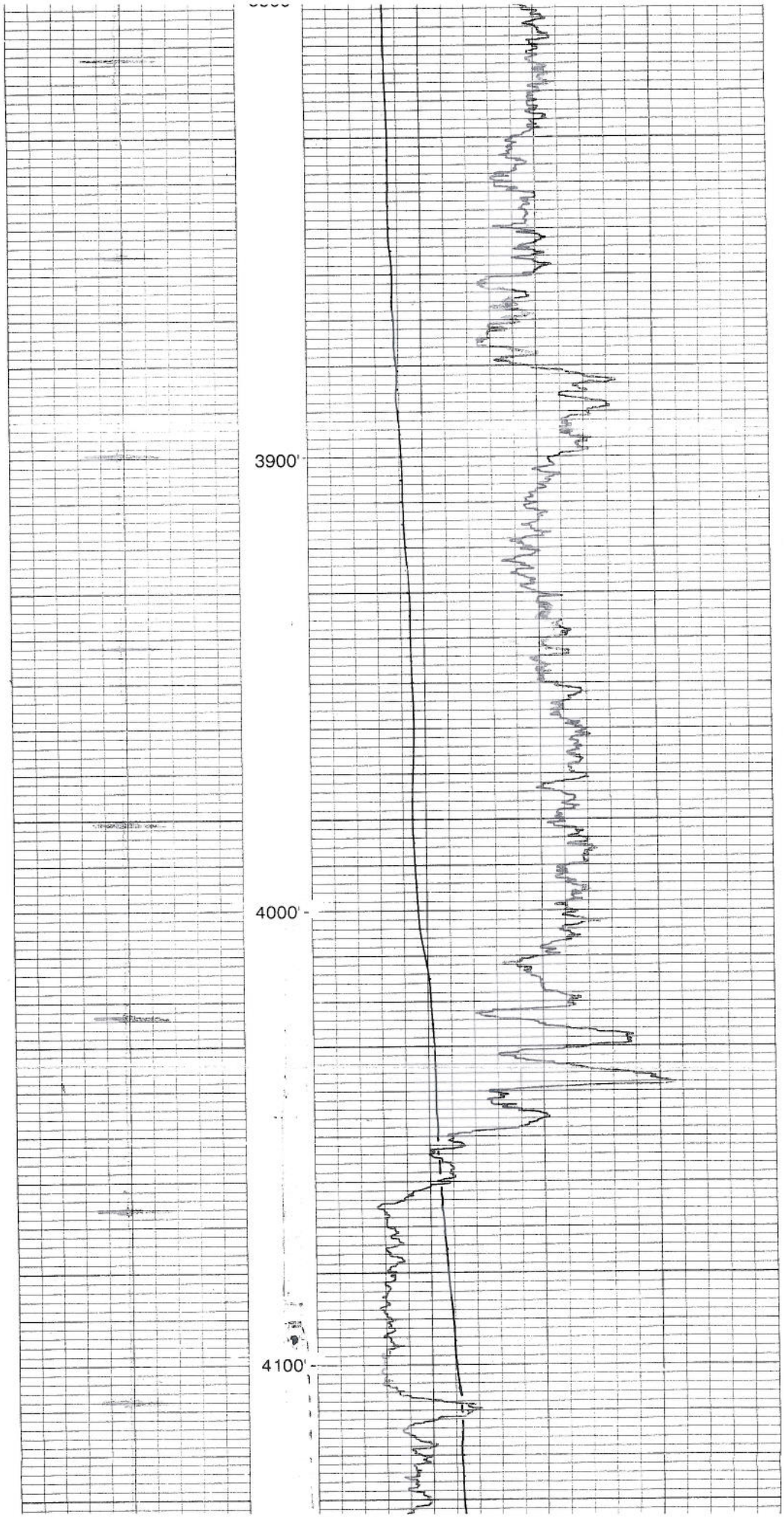
ELEV.: K.B. _____ D.F. _____ G.L. _____

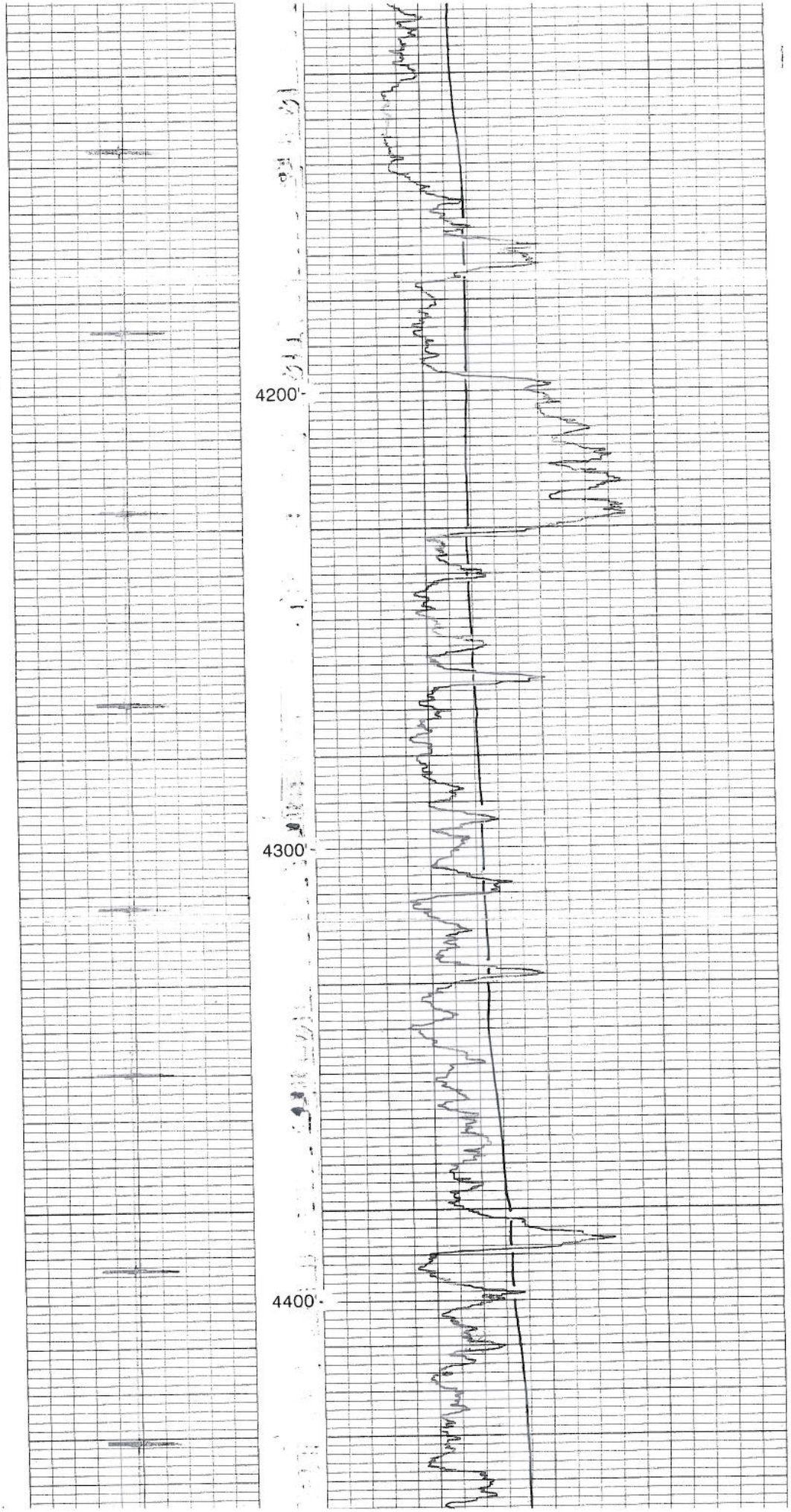
DATE	5-12-93		
RUN NO.			
TYPE LOG	GAMMA/TEMP		
DEPTH-DRILLER			
DEPTH-LOGGER	4596'		
BOTTOM LOGGED INTERVAL	4596'		
TOP LOGGED INTERVAL	3600'		
TYPE FLUID IN HOLE	WATER		
SALINITY, PPM CL.			
DENSITY			
LEVEL			
MAX. REC. TEMP., DEG F.	126.6°		
OPERATING RIG TIME			
RECORDED BY	CLARK		
WITNESSED BY	V.VERITY		
DISTRICT			

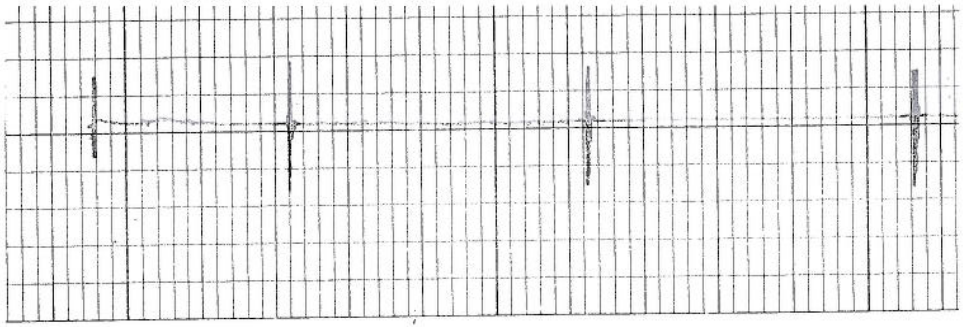
RUN	BORE-HOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
				10-3/4"	40.5#	0'	600'
				7"	20#	0'	3670'
				5"	15#	3363'	4650'

FORM # 101

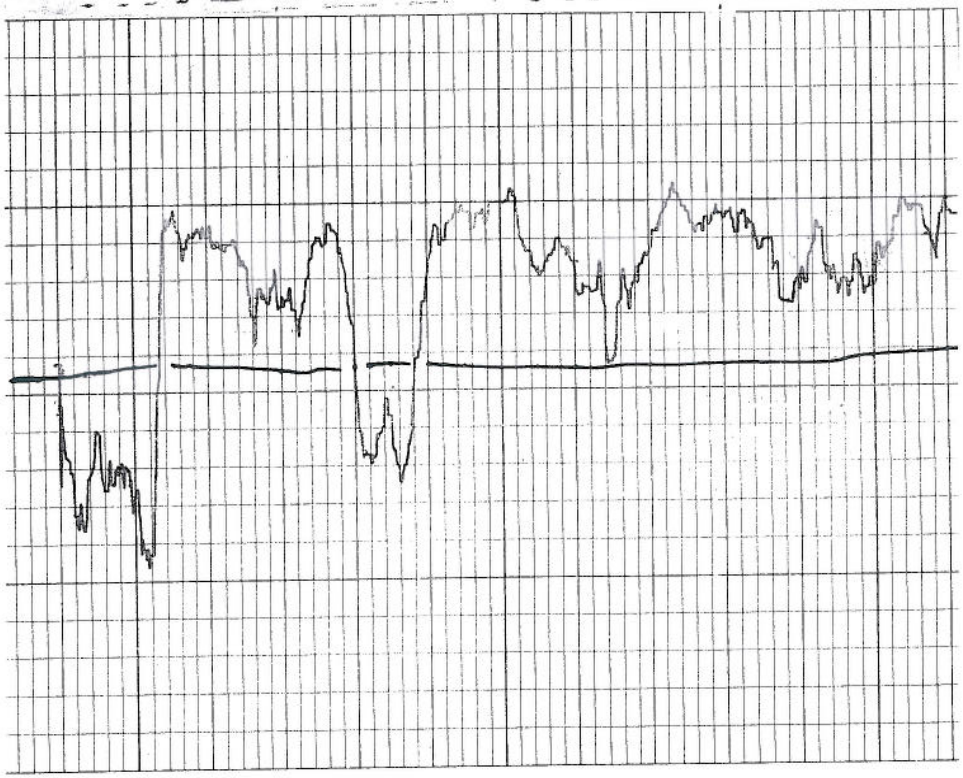



3900'
4000'
4100'


4200'
4300'
4400'



4500'



FLO-LOG INC.

TRACER SURVEY

COMPANY NORTHERN CALIF. POWER
WELL NO. LODI STIG #1
FIELD WHITE SLOUGH
COUNTY SAN JOAQUIN STATE CA
DATE 6-8-93

PURPOSE OF SURVEY

PERMANENT DATUM	20'K.B.	ELEVATION	6'
LOG MEASURED FROM		CORRECTED TO	
TOTAL DEPTH	4650'	OBSERVED DEPTH (Pickup)	4567'
TOP OF LOGGED INTERVAL	3260'	BOTTOM LOGGED INTERVAL	3700'
TYPE OF FLUID IN HOLE	WATER	FLUID LEVEL	
LOG RECORDED BY	CLARK	WITNESSED BY	B.VERITY

CASING AND TUBING RECORD

Size	Weight	From	To
10-3/4	40.5#	0'	611'
7"	20#	0'	3660'
5"	15#	3358'	4645'

WELL STATUS

Pressure	Producing	Injecting	Shut-in
TBG			
CSG			

INJ. RATE TYPE
OBS. RATE

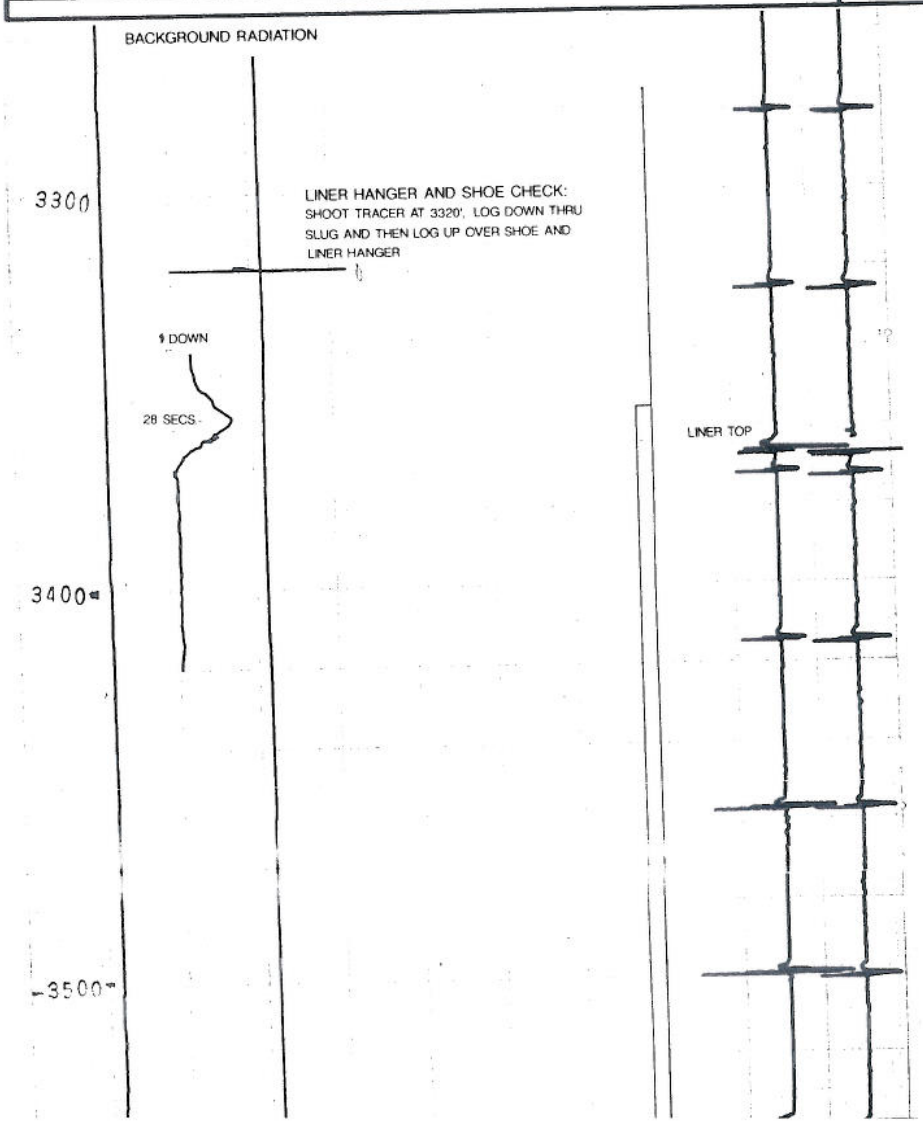
METERED PRODUCTION RATES: Oil Gravity: °API; Water; Gas

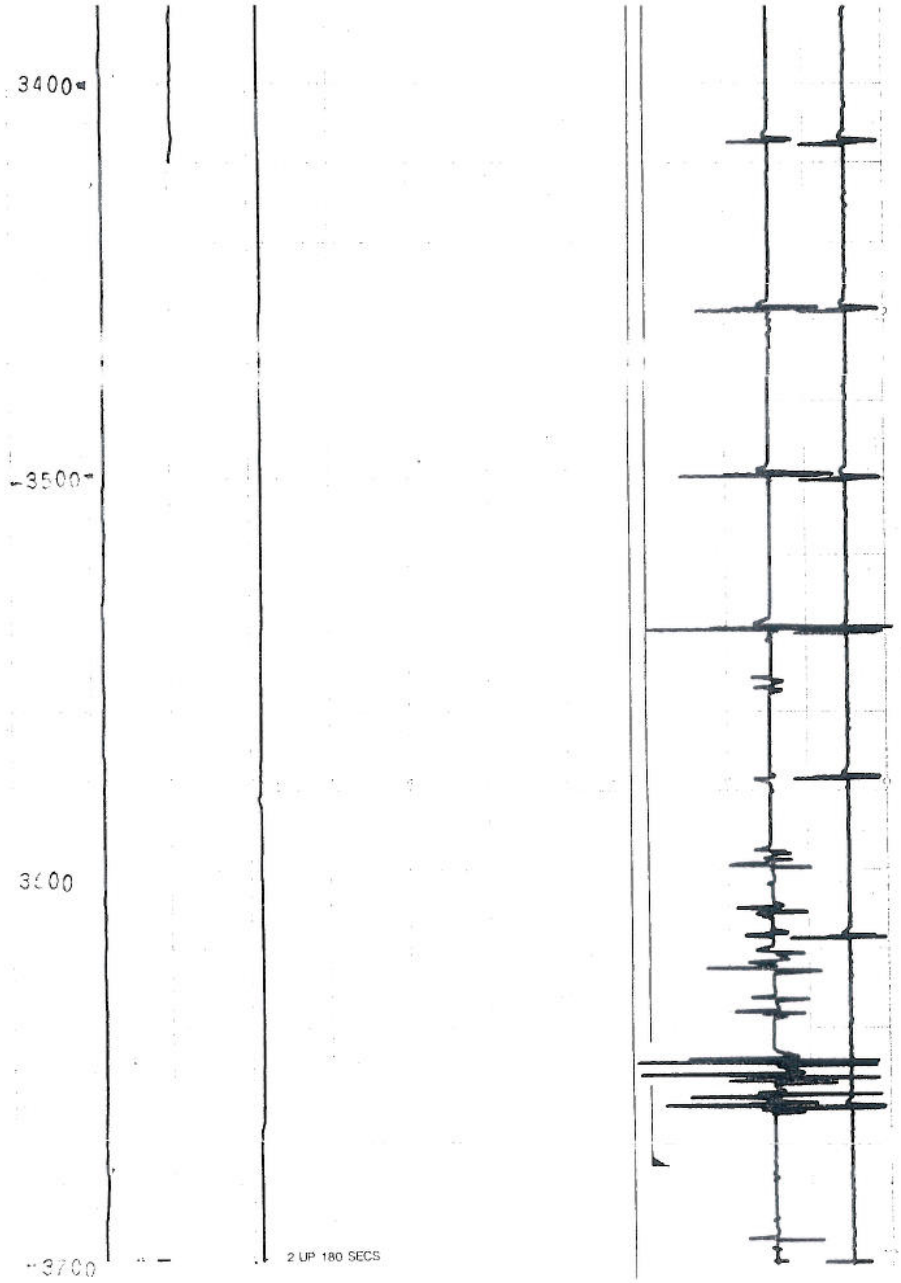
BOTTOM TEMPERATURE 126.6°

TUBING	NONE
PACKER(S)	NONE
MANDREL(S)	NONE
PERFORATIONS	

LOGGING UNIT
LINE SIZE 3/16" LINE LENGTH
TOOLS USED
TOOL NUMBERS
DIAMETER 1-3/8"

RESULTS AND REMARKS:




3400
3500
3600
3700
2 UP 180 SECS

FLO-LOG INC.

WATER INJECTION PROFILE

COMPANY N.C.P.A. FIELD WHITE SLOUGH WELL NAME STIG #1

SURVEY DATA			SECTION	TOWNSHIP	RANGE
DATE	6-8-93	SHUT-IN			
TYPE OF LOG	PTS, RA				
WELL STATUS	WATER DISPOSAL				
INJECTION RATE TEST #1	3 bpm=4320 B.D.				
INJECTION RATE TEST #2	5 bpm=7200 B.D.				
TUBING PRESSURE	NO TUBING				
CASING PRESSURE	150-250psi				
LOGGER'S DEPTH (pickup)	4567'				
AMOUNT OF FILL					
BOTTOM HOLE TEMPERATURE	123.5°				
LOGGING ENGINEER	TULUMELLO				
COMPANY REPRESENTATIVE	C.FISHER				
D.O.G. REPRESENTATIVE	--				

CASING AND TUBING RECORD

SIZE	WT.	FROM	TO	PERFORATIONS
7"	20#	0'	3660'	
5"	15#	3358'	4645'	4234'-4573' @ INTERVALS
2-3,8		4155'	4567'	4187'-4566' SLOTTED

WSO --	C.P. --
EFFECTIVE DEPTH	4567'
TUBING	NO TUBING
PACKER(s)	NONE
MANDREL(s)	NONE
MEASUREMENT DATUM	14'K.B.
DEPTH REFERENCE	LINER TOP AT 4155'

REASON FOR SURVEY FIRST SURVEY ON THIS NEW DISPOSAL WELL.

RADIOACTIVE TRACER CHECKS; Packer: OK(L.T.) CSG Valve: CLOSED Top Perf: OK Shoe: OK WSO: --

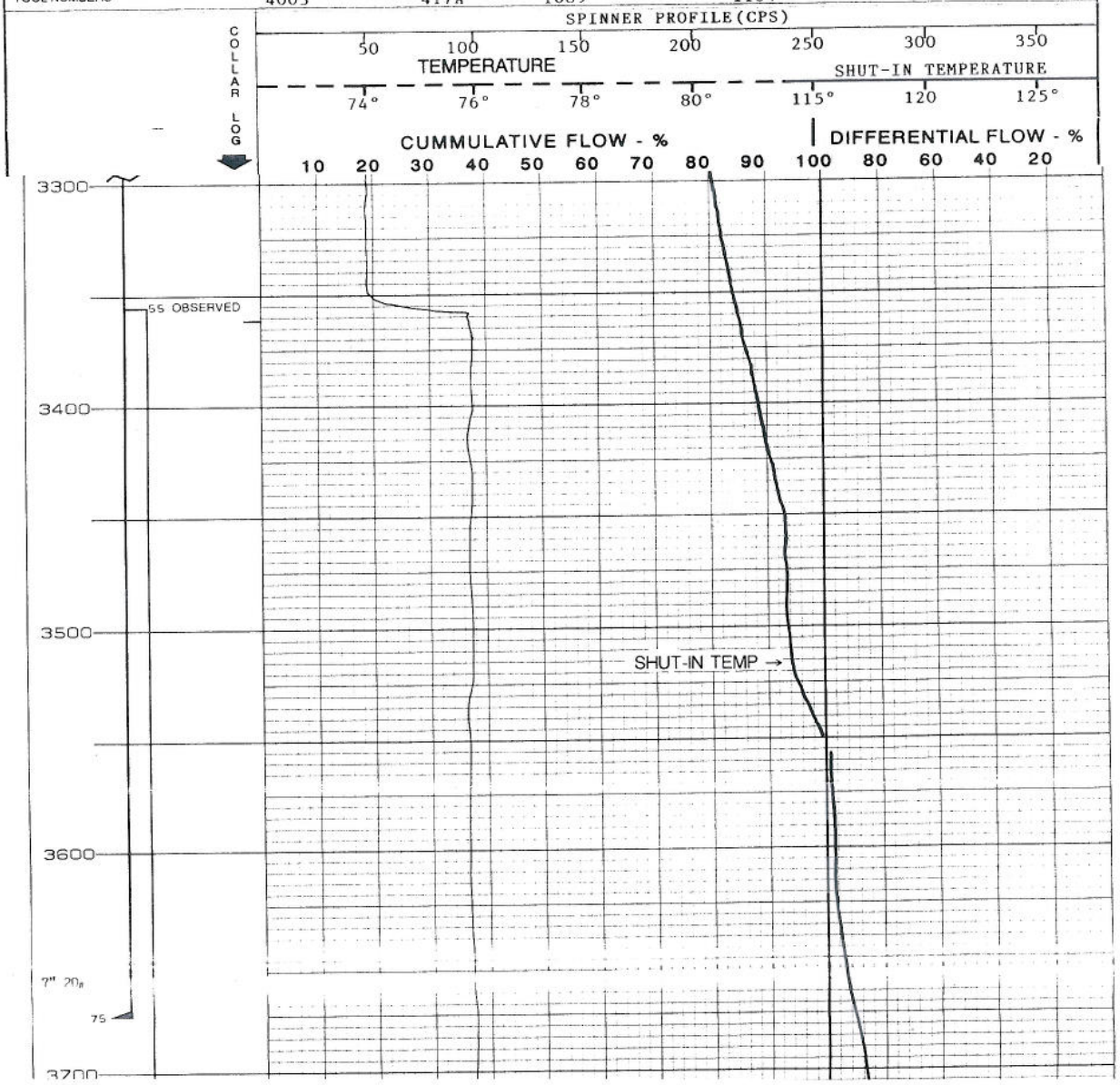
TRACER SHOWED A WATER VELOCITY OF BWPD AT (TOO FAST TO QUANTIFY)

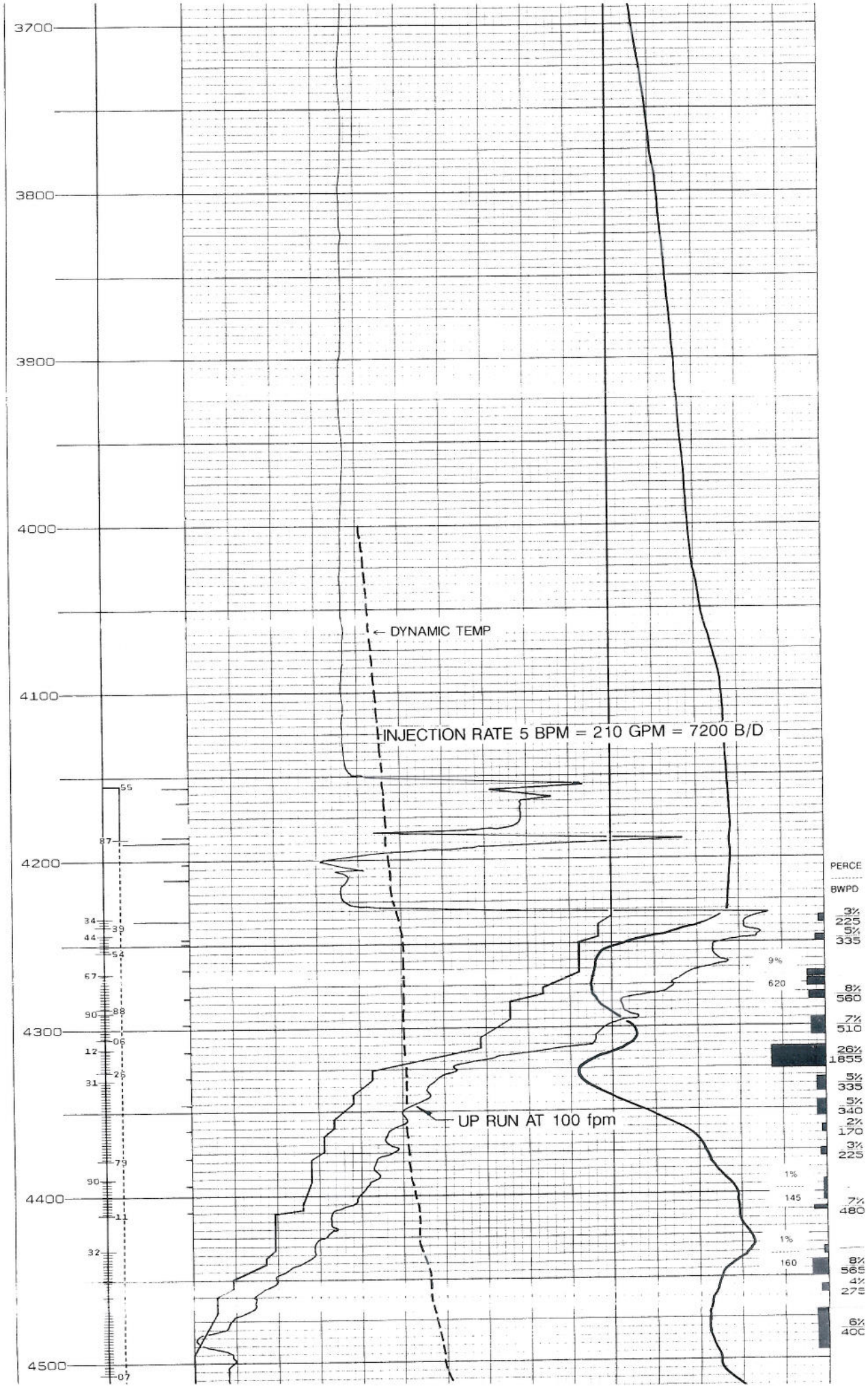
REMARKS: FOUND ORIGINAL SHUTIN FLUID AT 80'.
THE WELL WAS PUT ON INJECTION AFTER THE INITIAL SHUTIN TEMPERATURE WAS RUN TO BOTTOM.
TRACER SHOWED NO MIGRATION OR LEAKAGE FROM THIS WELL.

DIAGRAM OF TOOLS: 2-5'BARS, PRESSURE, INJECTOR, GAMMA, CCL, TEMPERATURE, SPINNER

DIAMETER OF TOOLS 1-3/8"

TOOL NUMBERS 4003 417A 1089 1104




3700
3800
3900
4000
4100
4200
4300
4400
4500
← DYNAMIC TEMP
INJECTION RATE 5 BPM = 210 GPM = 7200 B/D
UP RUN AT 100 fpm
PERCE
BWPD
3%
225
5%
335
9%
620
8%
560
7%
510
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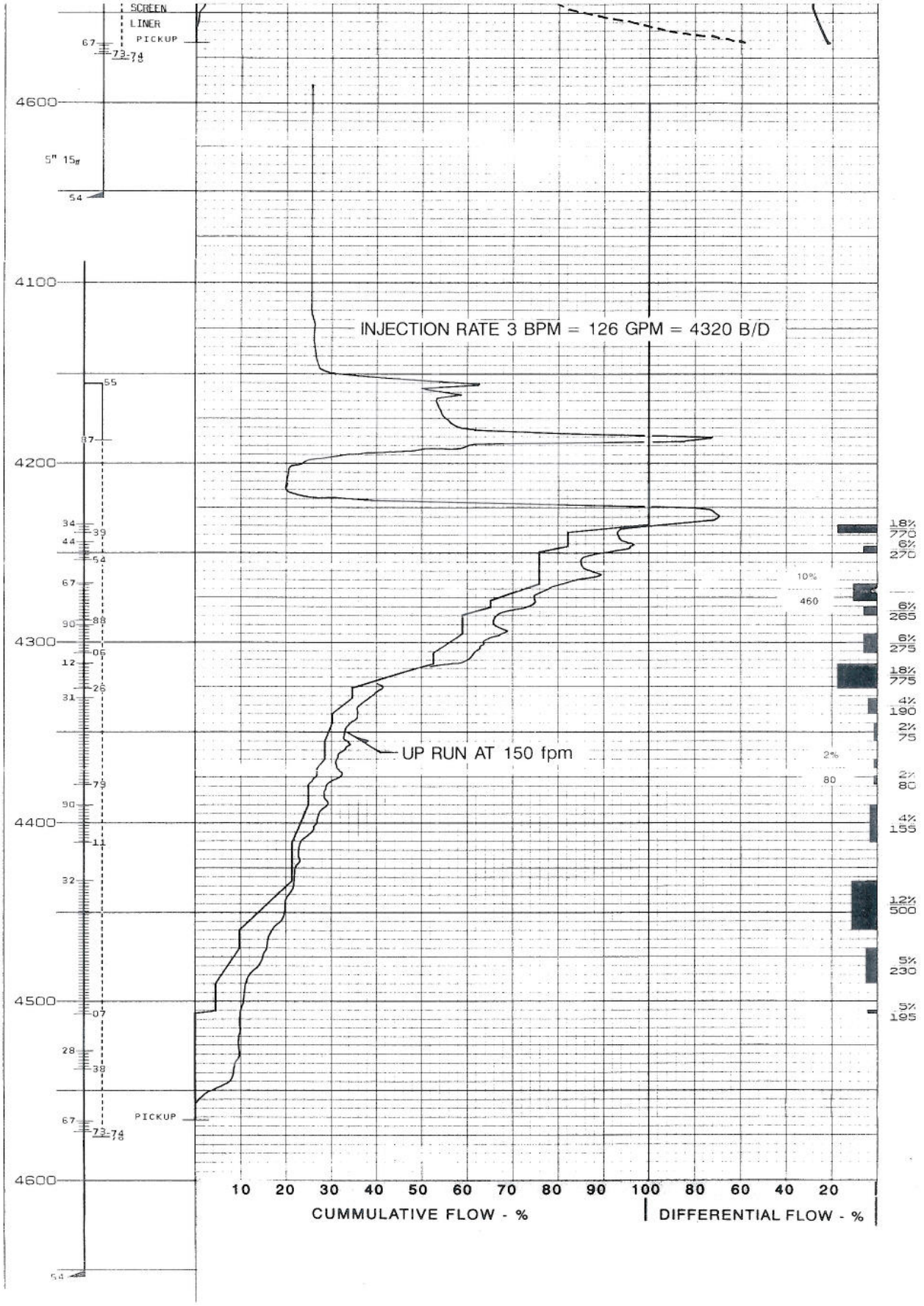
SCREEN
LINER
PICKUP
4600
5" 15#
4100
INJECTION RATE 3 BPM = 126 GPM = 4320 B/D
4200
4300
UP RUN AT 150 fpm
4400
4500
PICKUP
4600
10 20 30 40 50 60 70 80 90 100 80 60 40 20
CUMMULATIVE FLOW - %
DIFFERENTIAL FLOW - %
18% 770
6% 270
10% 460
6% 265
6% 275
18% 775
4% 190
2% 75
2% 80
2% 80
4% 155
12% 500
5% 230
5% 195

APPENDIX 12

Existing STIG Permits

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

March 22, 2007

Brad Jones
Northern California Power Agency
PO Box 1478
Lodi, CA 95241

RE: Revised Authority to Construct (ATC) N-2697-1-3
Project N-1071128

Dear Mr. Jones:

On March 20, 2007, the District received an email from Jeff Adkins of Sierra Research. In that email, Mr. Adkins pointed out that condition 35 of the above referenced ATC should limit the fuel sulfur content to 1.0 gr/100 scf, not 1.0 gr/scf as it currently does. The District concurs and has made the appropriate correction. Revised ATC N-2697-1-3 is enclosed.

Should you have any questions please telephone Mark Schonhoff at (209) 557-6448.

Sincerely,

David Warner
Director of Permit Services

Jim Swaney PE
Permit Services Manager

MJS

C: Jeff Adkins – Sierra Research

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Revised 3/21/07

AUTHORITY TO CONSTRUCT

PERMIT NO: N-2697-1-3 **ISSUANCE DATE:** 02/22/2007

LEGAL OWNER OR OPERATOR: NORTHERN CALIFORNIA POWER
MAILING ADDRESS: 180 CIRBY WAY
ROSEVILLE, CA 95678

LOCATION: 12751 N THORNTON RD
LODI, CA 95241

EQUIPMENT DESCRIPTION:
GENERAL ELECTRIC LM5000 NATURAL GAS FIRED TURBINE ENGINE WITH STEAM INJECTION, SELECTIVE CATALYTIC REDUCTION WITH AMMONIA INJECTION AND AN OXIDATION CATALYST. THE TURBINE POWERS A 49 MW ELECTRICAL GENERATOR. MODIFICATION TO CONVERT THE FUEL USAGE LIMIT TO THE TERMS OF HIGHER HEATING VALUE, REVISE THE EMISSION LIMITS TO CLARIFY THE TIME ALLOWED TO COME INTO COMPLIANCE, REVISE THE EXISTING DAILY EMISSION LIMITS TO THE PRECISION REQUIRED BY DISTRICT POLICY APR-1105 (GUIDELINES FOR THE USE OF SIGNIFICANT FIGURES IN ENGINEERING CALCULATIONS), ADD A SOX EMISSION LIMIT AND ADD A CONDITION REQUIRING THAT ALL RECORDS BE RETAINED FOR AT LEAST FIVE YEARS.

CONDITIONS

1. This unit shall be fired solely on PUC-quality natural gas. [District NSR Rule] Federally Enforceable Through Title V Permit
2. Operator shall operate and maintain in calibration a system which continuously measures and records: control system operating parameters, elapsed time of operation, and the exhaust gas NOx, CO and O2 concentrations. [40 CFR 60.334 (b)(1)(2), District NSR Rule and District Rule 1080] Federally Enforceable Through Title V Permit
3. The turbine and associated ancillary equipment must be maintained and kept in good operating condition at all times. [District NSR Rule] Federally Enforceable Through Title V Permit
4. A selective catalytic reduction (SCR) system shall be installed in the path of the heat recovery boiler where the temperature range is 450 to 750 degrees F. [District NSR Rule] Federally Enforceable Through Title V Permit
5. A SCR system shall have an effective catalyst volume of at least 100 cubic feet at all times. [District NSR Rule] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (209) 557-6400 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

DAVID WARNER, Director of Permit Services
N-2697-1-3 : Mar 21 2007 8:01AM -- SCHONHOM : Joint Inspection NOT Required

6. The catalyst bed and other components of the SCR system shall be made available for visual inspection by the District at least once a year. The District shall be notified at least 30 days prior to scheduling such inspection. [District NSR Rule] Federally Enforceable Through Title V Permit

7. The turbine shall be equipped with a CO catalyst to reduce CO and NMHC emissions. [District NSR Rule] Federally Enforceable Through Title V Permit

8. The turbine shall be equipped with an automatic air/fuel ratio control system. [District NSR Rule] Federally Enforceable Through Title V Permit

9. The permittee shall provide a continuous temperature monitoring and recording system to indicate the flue gas temperature through the SCR system. [District NSR Rule] Federally Enforceable Through Title V Permit

10. The stack height shall be minimum of 50 feet, and shall be adequate for stack sampling pursuant to EPA reference methods for source testing. [District NSR Rule] Federally Enforceable Through Title V Permit

11. Results of continuous emissions monitoring must be reduced according to the procedure established in 40 CFR, Part 51, Appendix P, paragraphs 5.0 through 5.3.3, or by other methods deemed equivalent by mutual agreement with the District, the ARB, and the EPA. [District Rule 1080, 7.2] Federally Enforceable Through Title V Permit

12. The NOx CEMS shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period or shall meet equivalent specifications established by mutual agreement of the District, the ARB and the EPA. [District Rule 1080, 6.4 and 40 CFR 60.334(b)(2)] Federally Enforceable Through Title V Permit

13. The continuous NOx and O2 monitoring system shall meet the performance specification requirements in 40 CFR 60, Appendix F, and Part 60, Appendix B, or shall meet equivalent specifications established by mutual agreement of the District,the ARB, and the EPA. [District Rule 1080, 6.7] Federally Enforceable Through Title V Permit

14. A violation of NOx emission standards indicated by the NOx CEM shall be reported by the operator to the APCO within 96 hours. [District Rule 1080, 9.0] Federally Enforceable Through Title V Permit

15. Operator shall notify the APCO no later than eight hours after the detection of a breakdown of the CEM. Operator shall inform the APCO of the intent to shut down the CEM at least 24 hours prior to the event. [District Rule 1080, 10.0] Federally Enforceable Through Title V Permit

16. Operations during periods of startup or shutdown shall not constitute representative conditions for the purpose of a NOx performance test nor shall NOx emissions in excess of the level of the emission limit shown in this permit during periods of startup and shutdown be considered a violation of the applicable emission limit unless otherwise specified in the applicable standard. [40 CFR 60.8(c)] Federally Enforceable Through Title V Permit

17. The owner or operator shall maintain records that contain the following: the occurrence and duration of any start-up, shutdown or malfunction, performance testing, evaluations, calibrations, checks, adjustments, any periods during which a continuous monitoring system or monitoring device is inoperative, maintenance of any CEM system that has been installed pursuant to District Rule 1080 (as amended 12/17/92), and emission measurements. [40 CFR 60.7(b) and District Rule 1080, 7.0] Federally Enforceable Through Title V Permit

18. The owner or operator shall, upon written notice from the APCO, provide a summary of the data obtained from the CEM systems. This summary of data shall be in the form and the manner prescribed by the APCO. [District Rule 1080, 7.1] Federally Enforceable Through Title V Permit

19. Results of the CEM system shall be averaged over a three hour period, using consecutive 15-minute sampling periods in accordance with all applicable requirements of CFR 60.13(h). [40 CFR 60.13(h), and District Rule 4703, 5.1, 6.4] Federally Enforceable Through Title V Permit

20. Operator shall maintain a stationary gas turbine operating log that includes, on a daily basis the actual local start-up and stop time, length and reason for reduced load periods, total hours of operation and quantity of fuel used. [District Rule 2520, 9.4.2] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

21. Operators of CEM systems installed at the direction of the APCO shall submit a written report for each calendar quarter to the APCO. The report is due on the 30th day following the end of the calendar quarter and shall include the following: Time intervals, data and magnitude of excess emissions, nature and cause of excess (if known), corrective actions taken and preventive measures adopted; Averaging period used for data reporting corresponding to the averaging period specified in the emission test period used to determine compliance with an emission standard; Applicable time and date of each period during which the CEM was inoperative, except for zero and span checks, and the nature of system repairs and adjustments; A negative declaration when no excess emissions occurred. [40 CFR 60.334 (j)(5) and District Rule 1080, 8.0] Federally Enforceable Through Title V Permit

22. The fuel consumption, based on the higher heating value of the fuel, shall not exceed 463 million Btu in any one hour. [District NSR Rule] Federally Enforceable Through Title V Permit

23. All emissions during start-up and shutdown periods shall be counted towards the applicable daily emissions limitations. [District NSR Rule] Federally Enforceable Through Title V Permit

24. The daily emission rates shall be calculated based on the hourly average stack concentrations and the calculated stack gas flow rates. [District NSR Rule] Federally Enforceable Through Title V Permit

25. The continuous emissions monitoring equipment shall be calibrated at least once per day. Relative Accuracy Testing shall be performed annually in accordance with 40 CFR Part 60, Appendices B & F or Part 75 if approved by the EPA. [District Rule 2080] Federally Enforceable Through Title V Permit

26. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201, 3.1] Federally Enforceable Through Title V Permit

27. The unit shall comply with the Rule 4703 NOx limit of 5 ppmvd @ 15% O2 within two hours of the commencement of start-up and shut-down periods as defined in Rule 4703. Within three hours of commencing the start-up or shutdown sequence, the NOx emissions shall not exceed 3.0 ppmvd @ 15% O2 over a three hour rolling average. [District Rules 2201 and 4703] Federally Enforceable Through Title V Permit

28. The unit shall comply with the Rule 4703 CO limit of 200 ppmvd @ 15% O2 within two hours of the commencement of start-up and shutdown periods as defined in Rule 4703. Within three hours of commencing the start-up or shutdown sequence, the CO emissions shall not exceed 200 ppmvd @ 15% O2 over a three hour rolling average [District Rules 2201 and 4703] Federally Enforceable Through Title V Permit

29. Sulfur compound emissions shall not exceed 0.0152% by volume, 150 ppmv, on a dry basis averaged over 15 consecutive minutes. [40 CFR 60.333(a); County Rules 404 (Madera), 406 (Fresno), and 407 (Kings, Merced, San Joaquin, Tulare, Kern, and Stanislaus)] Federally Enforceable Through Title V Permit

30. The ammonia slip shall not exceed 25 ppmv, dry, corrected to 15% O2. [District Rule 4102]

31. The NOx emissions shall not exceed 112.0 pounds during any one day. [District NSR Rule] Federally Enforceable Through Title V Permit

32. The PM10 emissions shall not exceed 48.0 pounds in any one day. [District NSR Rule] Federally Enforceable Through Title V Permit

33. The CO emissions shall not exceed 322.0 pounds in any one day. [District NSR Rule] Federally Enforceable Through Title V Permit

34. The VOC emissions shall not exceed 142.0 pounds during any one day. [District NSR Rule] Federally Enforceable Through Title V Permit

35. The fuel sulfur content shall not exceed 1.0 gr/100 scf. [District NSR Rule] Federally Enforceable Through Title V Permit

36. There shall be no visible emissions (except for uncombined water) from the entire system except during periods of startup and shutdown. [District NSR Rule] Federally Enforceable Through Title V Permit

37. Visible emissions shall be inspected annually during operation. If visible emissions are observed, corrective action shall be taken to eliminate visible emissions. If visible emissions cannot be corrected within 24 hours, a visible emissions test using EPA Method 9 shall be conducted. [District Rule 2520, 9.3.2] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

38. The owner or operator shall be required to conform to the compliance testing and sampling procedures described in District Rule 1081 (as amended 12/16/93). [District Rule 1081] Federally Enforceable Through Title V Permit

39. The owner or operator shall conduct and provide source test information annually regarding the exhaust gas NOx and CO concentration corrected to 15% O2 (dry). EPA Methods 7E or 20 shall be used for NOx emissions. EPA Methods 10 or 10B shall be used for CO emissions. EPA Methods 3, 3A, or 20 shall be used for Oxygen content of the exhaust gas. [40 CFR 60.8(a), 40 CFR 60.335(a)(b), District NSR Rule and District Rules 2520, Section 9.3.2, 4703, 5.1, 6.3.1, 6.4.1, 6.4.2, and 6.4.3] Federally Enforceable Through Title V Permit

40. The owner or operator shall conduct and provide source test information annually regarding, the NH3 emissions, and shall be measured using BAAQMD Method ST-1B. [District NSR Rule and District Rule 1081] Federally Enforceable Through Title V Permit

41. Source testing shall be conducted using the methods outlined in this permit and procedures approved by the District. The District must be notified 30 days prior to any compliance source test, and a source test plan must be submitted for approval 15 days prior to testing. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit

42. If the turbine is fired on PUC-regulated natural gas, then maintain on file copies of natural gas bills. [District Rule 2520, 9.3.2] Federally Enforceable Through Title V Permit

43. If the turbine is not fired on PUC-regulated natural gas, then the sulfur content of the natural gas being fired in the turbine shall be determined using ASTM method D 1072, D 4468, D 6667 or D 3246. [40 CFR 60.335(b)(10)(ii)] Federally Enforceable Through Title V Permit

44. If the turbine is not fired on PUC-regulated natural gas, the sulfur content of each fuel source shall be documented in a valid purchase contract, a supplier certification, tariff or transportation contract or tested daily in accordance with the requirements of 40 CFR 60.334 (h)(3) or (i)(2). [40 CFR 60.334(h)(3) and (i)(2)] Federally Enforceable Through Title V Permit

45. The operator shall submit a quarterly report of excess emissions and monitor downtime as defined and specified in 40 CFR 60.334 (b)(3) and (j). Excess emissions shall be reported for all periods of unit operation, including startup, shutdown and malfunction. [40 CFR 60.334 (b)(3) and (j)] Federally Enforceable Through Title V Permit

46. A daily log showing the hourly rate of ammonia injection and the pressure drop across the catalyst shall be maintained on the premises at all times. [District NSR Rule] Federally Enforceable Through Title V Permit

47. Compliance with permit conditions in the Title V permit shall be deemed compliance with the following subsumed requirements: Rules 404 (Madera), 406 (Fresno), and 407 (Kings, Merced, San Joaquin, Tulare, Kern, and Stanislaus) as of the date of permit issuance. A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

48. Compliance with permit conditions in the Title V permit shall be deemed compliance with the following applicable requirements: 40 CFR 60.332(a)(1), (b), 60.333 (b); 60.334, (b)(1), (b)(2), (b)(3), (h)(3), (i)(2), (j)(3); 60.335(a), (b)(1), (b)(2), and (b)(10)(ii); and District Rule 4703 (as amended 4/25/02), Sections 5.1.1, 5.2, 6.1, 6.3.1, 6.3.3, 6.4, 6.4.5, and 6.4.6. A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

49. Compliance with permit conditions in the Title V permit shall be deemed compliance with the following applicable requirements: 40 CFR 60.7(b), 60.8(a), (c), (d), and 60.13(b); District Rules 1080 (as amended 12/17/92), Sections 6.3, 6.4, 6.5, 7.0, 7.1, 7.2, 7.3, 8.0, 9.0, 10.0, and 11.0; and 1081 (as amended 12/16/93) as of the date of permit issuance. A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

50. The owners and operators of each affected source and each affected unit at the source shall have an Acid Rain permit and operate in compliance with all permit requirements. [40 CFR 72] Federally Enforceable Through Title V Permit

51. The owners and operators and, to the extent applicable, designated representative of each affected source and each affected unit at the source shall comply with the monitoring requirements as provided in 40 CFR part 75. [40 CFR 75] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

52. The emissions measurements recorded and reported in accordance with 40 CFR part 75 shall be used to determine compliance by the unit with the Acid Rain emissions limitations and emissions reduction requirements for sulfur dioxide and nitrogen oxides under the Acid Rain Program. [40 CFR 75] Federally Enforceable Through Title V Permit

53. The owners and operators of each source and each affected unit at the source shall: (i) Hold allowances, as of the allowance transfer deadline, in the unit's compliance subaccount (after deductions under 40 CFR 73.34(c)) not less than the total annual emissions of sulfur dioxide for the previous calendar year from the unit; and (ii) Comply with the applicable Acid Rain emissions limitations for sulfur dioxide. [40 CFR 73] Federally Enforceable Through Title V Permit

54. Each ton of sulfur dioxide emitted in excess of the Acid Rain emissions limitations for sulfur dioxide shall constitute a separate violation of the Act. [40 CFR 77] Federally Enforceable Through Title V Permit

55. Allowances shall be held in, deducted from, or transferred among Allowance Tracking System accounts in accordance with the Acid Rain Program. [40 CFR 72] Federally Enforceable Through Title V Permit

56. An allowance shall not be deducted in order to comply with the requirements under 40 CFR part 73, prior to the calendar year for which the allowance was allocated. [40 CFR 73] Federally Enforceable Through Title V Permit

57. An allowance allocated by the Administrator under the Acid Rain Program is a limited authorization to emit sulfur dioxide in accordance with the Acid Rain Program. No provision of the Acid Rain Program, the Acid Rain permit application, the Acid Rain permit, or the written exemption under 40 CFR 72.7 and 72.8 and no provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization. [40 CFR 72] Federally Enforceable Through Title V Permit

58. An allowance allocated by the Administrator under the Acid Rain Program does not constitute a property right. [40 CFR 72] Federally Enforceable Through Title V Permit

59. The designated representative of an affected unit that has excess emissions in any calendar year shall submit a proposed offset plan, as required under 40 CFR part 77. [40 CFR 77] Federally Enforceable Through Title V Permit

60. The owners and operators of an affected unit that has excess emissions in any calendar year shall: (i) Pay without demand the penalty required, and pay up on demand the interest on that penalty; and (ii) Comply with the terms of an approved offset plan, as required by 40 CFR part 77. [40 CFR 77] Federally Enforceable Through Title V Permit

61. The owners and operators of the each affected unit at the source shall keep on site the following documents for a period of five years from the date the document is created. This period may be extended for cause, at any time prior to the end of five years, in writing by the Administrator or permitting authority: (i) The certificate of representation for the designated representative for the source and all documents that demonstrate the truth of the statements in the certificate of representation, in accordance with 40 CFR 72.24; provided that the certificate and documents shall be retained on site beyond such five-year period until such documents are superceded because of the submission of a new certificate of representation changing the designated representative. [40 CFR 72] Federally Enforceable Through Title V Permit

62. The owners and operators of each affected unit at the source shall keep on site each of the following documents for a period of five years from the date the document is created. This period may be extended for cause, at any time prior to the end of five years, in writing by the Administrator or permitting authority; (ii) All emissions monitoring information, in accordance with 40 CFR part 75; (iii) Copies of all reports, compliance certifications and other submissions and all records made or required under the Acid Rain Program; (iv) Copies of all documents used to complete an Acid Rain permit application and any other submission that demonstrates compliance with the requirements of the Acid Rain Program. [40 CFR 75] Federally Enforceable Through Title V Permit

63. The designated representative of an affected source and each affected unit at the source shall submit the reports and compliance certifications required under the Acid Rain Program, including those under 40 CFR 75 Subpart I. [40 CFR 75] Federally Enforceable Through Title V Permit

64. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

65. All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rules 2530 and 4703] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

66. This Authority to Construct serves as a written Certificate of Conformity with the procedural requirements of 40 CFR 70.7 and 70.8 and with the compliance requirements of 40 CFR 70.6(c). [District Rule 2520] Federally Enforceable Through Title V Permit

67. Prior to operating with the modifications authorized by this Authority to Construct, the facility shall submit an application for an administrative amendment to its Title V permit, in accordance with District Rule 2520, Section 11.4.2. [District Rule 2520] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

FACILITY: N-2697-0-2

EXPIRATION DATE: 05/31/2009

FACILITY-WIDE REQUIREMENTS

1. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
2. The owner or operator shall notify the District of any breakdown condition as soon as reasonably possible, but no later than one hour after its detection, unless the owner or operator demonstrates to the District's satisfaction that the longer reporting period was necessary. [District Rule 1100, 6.1; County Rules 110 (Fresno, Stanislaus, San Joaquin); 109 (Merced); 113 (Madera); and 111 (Kern, Tulare, Kings)] Federally Enforceable Through Title V Permit
3. The District shall be notified in writing within ten days following the correction of any breakdown condition. The breakdown notification shall include a description of the equipment malfunction or failure, the date and cause of the initial failure, the estimated emissions in excess of those allowed, and the methods utilized to restore normal operations. [District Rule 1100, 7.0; County Rules 110 (Fresno, Stanislaus, San Joaquin); 109 (Merced); 113 (Madera); and 111 (Kern, Tulare, Kings)] Federally Enforceable Through Title V Permit
4. The owner or operator of any stationary source operation that emits more than 25 tons per year of nitrogen oxides or reactive organic compounds, shall provide the District annually with a written statement in such form and at such time as the District prescribes, showing actual emissions of nitrogen oxides and reactive organic compounds from that source. [District Rule 1160, 5.0] Federally Enforceable Through Title V Permit
5. Any person building, altering or replacing any operation, article, machine, equipment, or other contrivance, the use of which may cause the issuance of air contaminants or the use of which may eliminate, reduce, or control the issuance of air contaminants, shall first obtain an Authority to Construct (ATC) from the District unless exempted by District Rule 2020 (3/21/02). [District Rule 2010, 3.0 and 4.0; and 2020] Federally Enforceable Through Title V Permit
6. The permittee must comply with all conditions of the permit including permit revisions originated by the District. All terms and conditions of a permit that are required pursuant to the Clean Air Act (CAA), including provisions to limit potential to emit, are enforceable by the EPA and Citizens under the CAA. Any permit noncompliance constitutes a violation of the CAA and the District Rules and Regulations, and is grounds for enforcement action, for permit termination, revocation, reopening and reissuance, or modification; or for denial of a permit renewal application. [District Rules 2070, 7.0; 2080; and 2520, 9.8.1 and 9.12.1] Federally Enforceable Through Title V Permit
7. A Permit to Operate or an Authority to Construct shall not be transferred unless a new application is filed with and approved by the District. [District Rule 2031] Federally Enforceable Through Title V Permit
8. Every application for a permit required under Rule 2010 (12/17/92) shall be filed in a manner and form prescribed by the District. [District Rule 2040] Federally Enforceable Through Title V Permit
9. The operator shall maintain records of required monitoring that include: 1) the date, place, and time of sampling or measurement; 2) the date(s) analyses were performed; 3) the company or entity that performed the analysis; 4) the analytical techniques or methods used; 5) the results of such analysis; and 6) the operating conditions at the time of sampling or measurement. [District Rule 2520, 9.4.1] Federally Enforceable Through Title V Permit
10. The operator shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, or report. Support information includes copies of all reports required by the permit and, for continuous monitoring instrumentation, all calibration and maintenance records and all original strip-chart recordings. [District Rule 2520, 9.4.2] Federally Enforceable Through Title V Permit

FACILITY-WIDE REQUIREMENTS CONTINUE ON NEXT PAGE

Facility-wide Requirements for N-2697-0-2 (continued)

11. The operator shall submit reports of any required monitoring at least every six months unless a different frequency is required by an applicable requirement. All instances of deviations from permit requirements must be clearly identified in such reports. [District Rule 2520, 9.5.1] Federally Enforceable Through Title V Permit

12. Deviations from permit conditions must be promptly reported, including deviations attributable to upset conditions, as defined in the permit. For the purpose of this condition, promptly means as soon as reasonably possible, but no later than 10 days after detection. The report shall include the probable cause of such deviations, and any corrective actions or preventive measures taken. All required reports must be certified by a responsible official consistent with section 10.0 of District Rule 2520 (6/21/01). [District Rules 2520, 9.5.2 and 1100, 7.0] Federally Enforceable Through Title V Permit

13. If for any reason a permit requirement or condition is being challenged for its constitutionality or validity by a court of competent jurisdiction, the outcome of such challenge shall not affect or invalidate the remainder of the conditions or requirements in that permit. [District Rule 2520, 9.7] Federally Enforceable Through Title V Permit

14. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit. [District Rule 2520, 9.8.2] Federally Enforceable Through Title V Permit

15. The permit may be modified, revoked, reopened and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. [District Rule 2520, 9.8.3] Federally Enforceable Through Title V Permit

16. The permit does not convey any property rights of any sort, or any exclusive privilege. [District Rule 2520, 9.8.4] Federally Enforceable Through Title V Permit

17. The Permittee shall furnish to the District, within a reasonable time, any information that the District may request in writing to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the permittee shall also furnish to the District copies of records required to be kept by the permit or, for information claimed to be confidential, the permittee may furnish such records directly to EPA along with a claim of confidentiality. [District Rule 2520, 9.8.5] Federally Enforceable Through Title V Permit

18. The permittee shall pay annual permit fees and other applicable fees as prescribed in Regulation III of the District Rules and Regulations. [District Rule 2520, 9.9] Federally Enforceable Through Title V Permit

19. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 2520, 9.13.2.1] Federally Enforceable Through Title V Permit

20. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 2520, 9.13.2.2] Federally Enforceable Through Title V Permit

21. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under the permit. [District Rule 2520, 9.13.2.3] Federally Enforceable Through Title V Permit

22. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to sample or monitor, at reasonable times, substances or parameters for the purpose of assuring compliance with the permit or applicable requirements. [District Rule 2520, 9.13.2.4] Federally Enforceable Through Title V Permit

23. No air contaminants shall be discharged into the atmosphere for a period or periods aggregating more than 3 minutes in any one hour which is as dark or darker than Ringelmann #1 or equivalent to 20% opacity and greater, unless specifically exempted by District Rule 4101 (11/15/01). If the equipment or operation is subject to a more stringent visible emission standard as prescribed in a permit condition, the more stringent visible emission limit shall supersede this condition. [District Rule 4101, and County Rules 401 (in all eight counties in the San Joaquin Valley)] Federally Enforceable Through Title V Permit

FACILITY-WIDE REQUIREMENTS CONTINUE ON NEXT PAGE

Facility-wide Requirements for N-2697-0-2 (continued)

24. No person shall manufacture, blend, repackage, supply, sell, solicit or apply any architectural coating with a VOC content in excess of the corresponding limit specified in the Table of Standards of District Rule 4601 (10/31/01) for use or sale within the District. [District Rule 4601, 5.1] Federally Enforceable Through Title V Permit

25. All VOC-containing materials for architectural coatings subject to Rule 4601 (10/31/01) shall be stored in closed containers when not in use. [District Rule 4601, 5.4] Federally Enforceable Through Title V Permit

26. The permittee shall comply with all the Labeling and Test Methods requirements outlined in Rule 4601 sections 6.1 and 6.3 (10/31/01). [District Rule 4601, 6.1 and 6.3] Federally Enforceable Through Title V Permit

27. With each report or document submitted under a permit requirement or a request for information by the District or EPA, the permittee shall include a certification of truth, accuracy, and completeness by a responsible official. [District Rule 2520, 9.13.1 and 10.0] Federally Enforceable Through Title V Permit

28. If the permittee performs maintenance on, or services, repairs, or disposes of appliances, the permittee shall comply with the standards for Recycling and Emissions Reduction pursuant to 40 CFR 82, Subpart F. [40 CFR 82 Subpart F] Federally Enforceable Through Title V Permit

29. If the permittee performs service on motor vehicles when this service involves the ozone-depleting refrigerant in the motor vehicle air conditioner (MVAC), the permittee shall comply with the standards for Servicing of Motor Vehicle Air Conditioners pursuant to all the applicable requirements as specified in 40 CFR 82, Subpart B. [40 CFR 82, Subpart B] Federally Enforceable Through Title V Permit

30. Disturbances of soil related to any construction, demolition, excavation, extraction, or other earthmoving activities shall comply with the requirements for fugitive dust control in District Rule 8021 unless specifically exempted under Section 4.0 of Rule 8021 (11/15/01) or Rule 8011 (11/15/01). [District Rule 8021 and 8011] Federally Enforceable Through Title V Permit

31. Outdoor handling, storage and transport of any bulk material which emits dust shall comply with the requirements of District Rule 8031, unless specifically exempted under Section 4.0 of Rule 8031 (11/15/01) or Rule 8011 (11/15/01). [District Rule 8031 and 8011] Federally Enforceable Through Title V Permit

32. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Section 4.0 of Rule 8041 (11/15/01) or Rule 8011 (11/15/01). [District Rule 8041 and 8011] Federally Enforceable Through Title V Permit

33. Whenever open areas are disturbed or vehicles are used in open areas, the facility shall comply with the requirements of Section 5.0 of District Rule 8051, unless specifically exempted under Section 4.0 of Rule 8051 (11/15/01) or Rule 8011 (11/15/01). [District Rule 8051 and 8011] Federally Enforceable Through Title V Permit

34. Any paved road or unpaved road shall comply with the requirements of District Rule 8061 unless specifically exempted under Section 4.0 of Rule 8061 (11/15/01) or Rule 8011 (11/15/01). [District Rule 8061 and Rule 8011] Federally Enforceable Through Title V Permit

35. Any unpaved vehicle/equipment area that anticipates more than 75 vehicle trips per day shall comply with the requirements of Section 5.1.1 of District Rule 8071. Any unpaved vehicle/equipment area that anticipates more than 100 vehicle trips per day shall comply with the requirements of Section 5.1.2 of District Rule 8071. All sources shall comply with the requirements of Section 5.0 of District Rule 8071 unless specifically exempted under Section 4.0 of Rule 8071 (11/15/01) or Rule 8011 (11/15/01). [District Rule 8071 and Rule 8011] Federally Enforceable Through Title V Permit

36. Any owner or operator of a demolition or renovation activity, as defined in 40 CFR 61.141, shall comply with the applicable inspection, notification, removal, and disposal procedures for asbestos containing materials as specified in 40 CFR 61.145 (Standard for Demolition and Renovation). [40 CFR 61 Subpart M] Federally Enforceable Through Title V Permit

FACILITY-WIDE REQUIREMENTS CONTINUE ON NEXT PAGE

Facility-wide Requirements for N-2697-0-2 (continued)

37. The permittee shall submit certifications of compliance with the terms and standards contained in Title V permits, including emission limits, standards and work practices, to the District and the EPA annually (or more frequently as specified in an applicable requirement or as specified by the District). The certification shall include the identification of each permit term or condition, the compliance status, whether compliance was continuous or intermittent, the methods used for determining the compliance status, and any other facts required by the District to determine the compliance status of the source. [District Rule 2520, 9.16] Federally Enforceable Through Title V Permit

38. The permittee shall submit an application for Title V permit renewal to the District at least six months, but not greater than 18 months, prior to the permit expiration date. [District Rule 2520, 5.2] Federally Enforceable Through Title V Permit

39. When a term is not defined in a Title V permit condition, the definition in the rule cited as the origin and authority for the condition in a Title V permits shall apply. [District Rule 2520, 9.1.1] Federally Enforceable Through Title V Permit

40. Compliance with permit conditions in the Title V permit shall be deemed in compliance with the following outdated SIP requirements: Rule 401 (Madera, Fresno, Kern, Kings, San Joaquin, Stanislaus, Tulare and Merced), Rule 110 (Fresno, Stanislaus, San Joaquin), Rule 109 (Merced), Rule 113 (Madera), and Rule 111 (Kern, Tulare, Kings). A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

41. Compliance with permit conditions in the Title V permit shall be deemed in compliance with the following applicable requirements: SJVUAPCD Rules 1100, sections 6.1 and 7.0 (12/17/92); 2010, sections 3.0 and 4.0 (12/17/92); 2031 (12/17/92); 2040 (12/17/92); 2070, section 7.0 (12/17/92); 2080 (12/17/92); 4101 (11/15/01); 4601, sections 5.1, 5.2, 5.3, 5.8 and 8.0 (10/31/01); 8021 (11/15/01); 8031 (11/15/01); 8041 (11/15/01); 8051 (11/15/01); 8061 (11/15/01); and 8071 (11/15/01). A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

42. The reporting periods for the Report of Required Monitoring and the Compliance Certification Report begin January 1 of each year, unless alternative dates are approved by the District Compliance Division. These reports are due within 30 days after the end of the reporting period. [District Rule 2520] Federally Enforceable Through Title V Permit

CT-2
STI6

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-2697-4-2 **EXPIRATION DATE:** 05/31/2009

EQUIPMENT DESCRIPTION:
240 HP CUMMINS MODEL 6CTA8.3-F1 DIESEL FIRED IC ENGINE WITH A TURBOCHARGER AND AFTERCOOLER SYSTEM POWERING AN EMERGENCY FIRE PUMP

PERMIT UNIT REQUIREMENTS

1. Sulfur compound emissions shall not exceed 0.2% by volume, 2000 ppmv, on a dry basis averaged over 15 consecutive minutes. [County Rules 404 (Madera), 406 (Fresno), and 407 (Kings, Merced, San Joaquin, Tulare, Kern, and Stanislaus)] Federally Enforceable Through Title V Permit
2. Unit shall be fired only on diesel fuel with a sulfur content of less than 0.05% by weight. [County Rules 404 (Madera), 406 (Fresno), and 407 (Kings, Merced, San Joaquin, Tulare, Kern, and Stanislaus)] Federally Enforceable Through Title V Permit
3. If the IC engine is fired on Air Resources Board regulated diesel fuel, with a supplier certified sulfur content less than 0.05% by weight, the operator shall maintain copies of all fuel invoices and supplier certifications. [District Rule 2520, 9.3.2] Federally Enforceable Through Title V Permit
4. If the IC engine is not fired on ARB regulated diesel fuel, with a supplier certified sulfur content less than 0.05% by weight, then the owner or operator shall determine the sulfur content of each delivery of diesel fuel being fired in the IC engine. The sulfur content shall be determined using ASTM method D 2880. [District Rule 2520, 9.3.2] Federally Enforceable Through Title V Permit
5. The NOx emissions rate shall not exceed 6.12 grams/BHP-hr. [District NSR Rule] Federally Enforceable Through Title V Permit
6. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201, 3.1] Federally Enforceable Through Title V Permit
7. This engine shall be operated only for maintenance, testing, and required regulatory purposes, and during emergency situations. Operation of the engine for maintenance, testing and required regulatory purposes shall not exceed 200 hours per year. [District NSR Rule and District Rule 4701, 4.2.1] Federally Enforceable Through Title V Permit
8. The permittee shall maintain records of hours of emergency and non-emergency operation. Records shall include the date, the number of hours of operation, the purpose of the operation (e.g., load testing, weekly testing, rolling blackout, general area power outage, etc.), and the sulfur content of the diesel fuel used. Such records shall be retained on-site for a period of at least five years and made available for District inspection upon request. [District Rule 1070 and Rule 2520, 9.4.2] Federally Enforceable Through Title V Permit
9. Compliance with permit conditions in the Title V permit shall be deemed compliance with the following subsumed requirements: Rules 404 (Madera), 406 (Fresno), and 407 (Kings, Merced, San Joaquin, Tulare, Kern, and Stanislaus). A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

APPENDIX 13

Well Installation Permit Applications

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

NOTICE OF INTENTION TO DRILL NEW WELL

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS _____	NEG. DEC. ☐ S.C.H. NO. _____	E.I.R. ☐ S.C.H. NO. _____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☐
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS	
				114	121

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence

drilling well_____, well type_____, API No._____ ,
(Assigned by Division)

Sec. _____, _____ , _____, _____B.&M.,_____ Field, _____County.

Legal description of mineral-right lease, consisting of_____acres (attach map or plat to scale), is as follows:

Do mineral and surface leases coincide? Yes ☐ No ☐ . If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well _____ feet_____along section ☐ / property ☐ line and_____ feet_____
(Direction) (Check one) (Direction)

at right angles to said line from the_____ corner of section ☐ / property ☐_____ or
(Check one)

Is this a critical well according to the definition on the next page of this form? Yes ☐ No ☐

If well is to be directionally drilled, show proposed coordinates (from surface location) and true vertical depth at total drilled depth:
_____ feet_____ and_____ feet _____Estimated true vertical depth_____. Elevation of ground above
(Direction) (Direction)

sea level_____feet. All depth measurements taken from top of_____ that is _____ feet above ground.
(Derrick Floor, Rotary Table, or Kelly Bushing)

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s)
of completion _____Estimated total depth _____
(Name, depth, and expected pressure) (Feet)

_____

It is understood that if changes to this plan become necessary, we are to notify you immediately.

Name of Operator		Type of Organization (Corporation, Partnership, Individual, etc.)	
Address		City	Zip Code
Telephone Number	Name of Person Filing Notice	Signature	Date

This notice and an indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

OG105 (1/08)

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: _____

Lead Agency Contact Person: _____

Address: _____

_____

Phone: ( )_____

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks: _____
_____
_____

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720 (a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

SAN JOAQUIN COUNTY

ENVIRONMENTAL HEALTH DEPARTMENT

600 East Main Street, Stockton, CA 95202-3029

Telephone: (209) 468-3449 ***Fax:*** (209) 468-3433 ***Web:*** www.sjgov.org/ehd

SITE MITIGATION UNIT IV

WELL PERMIT APPLICATION

NON-REFUNDABLE PERMIT EXPIRES 1 YEAR FROM DATE ISSUED

Application is hereby made to San Joaquin County for a permit to construct and/or install the work described. This application is made in compliance with San Joaquin County Development Title, chapter 9-1115.3 and the Standards of San Joaquin County Environmental Health Department.

Well Location _____ Cross Street _____ City _____ Zip _____ Assessor's Parcel # _____

Property Owner _____ Address _____ City _____ Zip _____ Phone # _____

C-57 Contractor _____ Address _____ City _____ Lic # _____ Phone _____

Consultant/Sub Cntr _____ Address _____ City _____ Lic # _____ Phone _____

GIS Coordinates: X _____ , Y _____ , Township _____ Range _____ Section _____

WORK TO BE PERFORMED:

☐ **NEW WELL/BORING** (CPT, GEOPROBE, HYDROPUNCH, HAND-AUGER, **OTHER***)
- ☐ SOIL BORING# _____
- ☐ WELL # _____
- ☐ ***OTHER** _____

☐ **DESTRUCTION** (CHOOSE TYPE BELOW)
- ☐ OVER-BORE DIAMETER _____
- ☐ PRESSURE GROUT _____
- GROUT SPECIFICATIONS _____

COMMENTS: _____

TYPE OF WELL	INSTALLATION TYPE	CONSTRUCTION SPECIFICATIONS
☐ MONITORING	☐ HOLLOW STEM	DIA. OF BOREHOLE _____ ☐ MULTIPLE CASINGS ☐ MULTI-LEVEL WELL CASING DIA: _____
☐ EXTRACTION	☐ AIR HAMMER/DRIVEN	CASING THICKNESS _____ TYPE OF CASING: ☐ STEEL ☐ PVC ☐ OTHER _____
☐ VAPOR	☐ MUD ROTARY _____	DEPTH OF GROUT SEAL _____ TREMIE TYPE TO BE USED ☐ AUGERS ☐ HOSE
☐ AIR SPARGE/OZONE	☐ PUSH POINT (GP OR CPT)_____	GROUT SEAL PUMPED: ☐ Yes ☐ No (**NOTE: MAXIMUM FREE-FALL DEPTH IS 30'**)
☐ SOIL BORING	☐ HAND AUGER _____	GROUT SPECIFICATIONS _____
☐ OTHER: _____	☐ OTHER: _____	APPROX. BORING DEPTH _____ ☐ BOLTED TRAFFIC BOX **OR** ☐ STOVE PIPE CONDUCTOR CASING PROPOSED _____ (if **YES**, list specifications in comment section)

COMMENTS: _____

NOTE: OFFSITE BORINGS REQUIRE ACCESS AGREEMENT OR ENCROACHMENT PERMITS

48 WORKING HOURS NOTICE REQUIRED FOR INSPECTIONS

I hereby certify that I have prepared this application and that the work will be done I accordance with San Joaquin County Ordinances, Rules and Regulations, and all applicable California Laws.

Signed _____ Title/Company _____

Print Name _____ Date _____

DEPARTMENT USE ONLY

SITE MAP IN UNIT IV FILE, ADDRESS: _____

WORK PLAN DATED: _____

APPLICATION ACCEPTED BY _____ DATE ISSUED _____ AREA _____

GROUT INSPECTION BY _____ FINAL INSPECTION BY _____ DATE _____

DESTRUCTION INSPECTION BY _____ DATE _____

COMMENTS/CONDITIONS: _____

ACCOUNTING ONLY:		AID #		FAC #			
PE CODES	**FEE INFO**	**AMT REMITTED**	**CHECK #**	**RECV'D BY**	**DATE**	**PERMIT/SERVICE #**	**INVOICE**
						SR#	

C-57 _____ WC _____ -WAIVER _____ C57 LETTER OF AUTHORIZATION TO SIGN PERMIT _____ ENCROACHMENT DOC _____

San Joaquin County Environmental Health Department Unit IV Well Permit Application Supplemental

JOB ADDRESS: _____ **PERMIT SR #** _____

LICENSED CONTRACTORS DECLARATION (LCD)

I hereby affirm that I am licensed under the provisions of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code and my license is in full force and effect.

License #: _____ Exp Date: _____

Date: _____ Contractor: _____

Signature: _____ Title: _____

Print Name: _____

WORKER'S COMPENSATION DECLARATION

I hereby affirm under penalty of perjury one of the following declarations: **(check one)**

_____ I have and will maintain a certificate of consent to self-insure for workers' compensation, as provided for by section 3700 of the labor Code, for the performance of the work for which this permit is issued.

_____ I have and will maintain workers' compensation insurance, as required by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued. My workers' compensation insurance carrier and policy numbers are:

Carrier:_____ **Policy Number:** _____

I certify that in the performance of the work for which this permit is issued, I shall not employ any person in any manner so as to become subject to the workers' compensation law of California, and agree that if I should become subject to workers' compensation provisions of Section 3700 of the Labor Code, I shall forthwith comply with those provisions.

Exp. Date:_____ **Signature:** _____

Print Name: _____

WARNING: FAILURE TO SECURE WORKERS' COMPENSATION COVERAGE IS UNLAWFUL, AND SHALL SUBJECT AN EMPLOYER TO CRIMINAL PENALTIES AND CIVIL FINES UP TO $100,000, IN ADDITION TO THE COST OF COMPENSATION, INTEREST, ATTORNEY'S FEES, AND DAMAGES AS PROVIDED FOR IN SECTION 3706 OF THE LABOR CODE.

AUTHORIZATION FOR OTHER THAN C-57 SIGNING PERMIT APPLICATION

I, _____ (signature of C-57 licensed authorized representative), hereby authorize (print name) _____ , to sign this San Joaquin county Well Permit Application on my behalf. I understand this authorization is valid for one year and is limited to the work plan dated on the front page of this application.

8/29/02/MI