Form 9-331 C
(May 1963)

SUBMIT IN TRIPLICATE*
(Other instructions on reverse side)

Form approved.
Budget Bureau No. 42-R1425.

30-043-20325

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR PERMIT TO DRILL, DEEPEN, OR PLUG BACK

5. LEASE DESIGNATION AND SERIAL NO.: Jic. Cont. 409

6. IF INDIAN, ALLOTTEE OR TRIBE NAME:

1a. TYPE OF WORK
DRILL [XX] DEEPEN [ ] PLUG BACK [ ]

7. UNIT AGREEMENT NAME:

b. TYPE OF WELL
OIL WELL [XX] GAS WELL [XX] OTHER SINGLE ZONE [ ] MULTIPLE ZONE [ ]

8. FARM OR LEASE NAME: Jic. Apache "M"

2. NAME OF OPERATOR: Amerada Hess Corporation

9. WELL NO.: 1

3. ADDRESS OF OPERATOR: P. O. Box 2040, Tulsa, Oklahoma 74102

10. FIELD AND POOL, OR WILDCAT: Ballard Picture Cliff Ext ✓ Basin Dakota

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.*)
At surface: 800' FNL, 800' FEL ✓
A
At proposed prod. zone: Same

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Sec. 5, T22N, R3W

14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE*: Est. 25 miles North Cuba, New Mexico

12. COUNTY OR PARISH: Sandoval

13. STATE: New Mexico

15. DISTANCE FROM PROPOSED* LOCATION TO NEAREST PROPERTY OR LEASE LINE, FT. (Also to nearest drlg. unit line, if any)	16. NO. OF ACRES IN LEASE	17. NO. OF ACRES ASSIGNED TO THIS WELL
NA	1920	Dakota 320 -Picture Cliff 160
18. DISTANCE FROM PROPOSED LOCATION* TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR, ON THIS LEASE, FT.	**19. PROPOSED DEPTH**	**20. ROTARY OR CABLE TOOLS**
NA	7,000'	Rotary

21. ELEVATIONS (Show whether DF, RT, GR, etc.): 7246' GR

22. APPROX. DATE WORK WILL START*: May 15, 1978

23. PROPOSED CASING AND CEMENTING PROGRAM

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	SETTING DEPTH	QUANTITY OF CEMENT
13 3/4"	9 5/8"	32#	300	250 sx.
8 3/4"	5 1/2"	15.5# & 17#	6915	600 sx.

Plan to drill from surface to 300'. Run, set and cement 9 5/8" casing. WOC and drill out from under 9 5/8" casing to the Mancos Shale to proposed TD 7,000' or sufficient depth to the Dakota gas sand. Log well and if productive, complete as a dual gas well with 5 1/2" casing set at TD and cement. No cores or DST are anticipated.

Mud program is to use low viscosity and low water loss mud from under surface casing to TD with viscosity 35-40 for logging.

Attachments: BOP equipment program, NTL-6, surface usage plan, location maps, plats and drilling rig layout plan.

Gas is dedicated

MAY 5 1978
OIL CON. COM.
DIST. 3

IN ABOVE SPACE DESCRIBE PROPOSED PROGRAM: If proposal is to deepen or plug back, give data on present productive zone and proposed new productive zone. If proposal is to drill or deepen directionally, give pertinent data on subsurface locations and measured and true vertical depths. Give blowout preventer program, if any.

24.

SIGNED H S Porter TITLE Supv. Drlg. Admin. Serv. DATE 4-17-78

(This space for Federal or State office use)

PERMIT NO. _____ APPROVAL DATE _____

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

ok Frank

RECEIVED
MAY 1 1978
U. S. GEOLOGICAL SURVEY
DURANGO, COLO.

*See Instructions On Reverse Side

SF

NEW MEXICO OIL CONSERVATION COMMISSION

WELL LOCATION AND ACREAGE DEDICATION PLAT

Form C-102
Supersedes C-128
Effective 1-1-65

All distances must be from the outer boundaries of the Section.

Operator	Lease	Well No.
Amerada Hess Corporation	Jicarilla Apache M	1

Unit Letter	Section	Township	Range	County
A	5	22N	3W	Sandoval

Actual Footage Location of Well:
800 feet from the North line and 800 feet from the East line

Ground Level Elev.	Producing Formation	Pool	Dedicated Acreage:
7246	Basin Dakota Ballard Picture Cliffs	Basin Dakota Ballard Picture Cliff Ext.	See Below Acres

1. Outline the acreage dedicated to the subject well by colored pencil or hachure marks on the plat below.

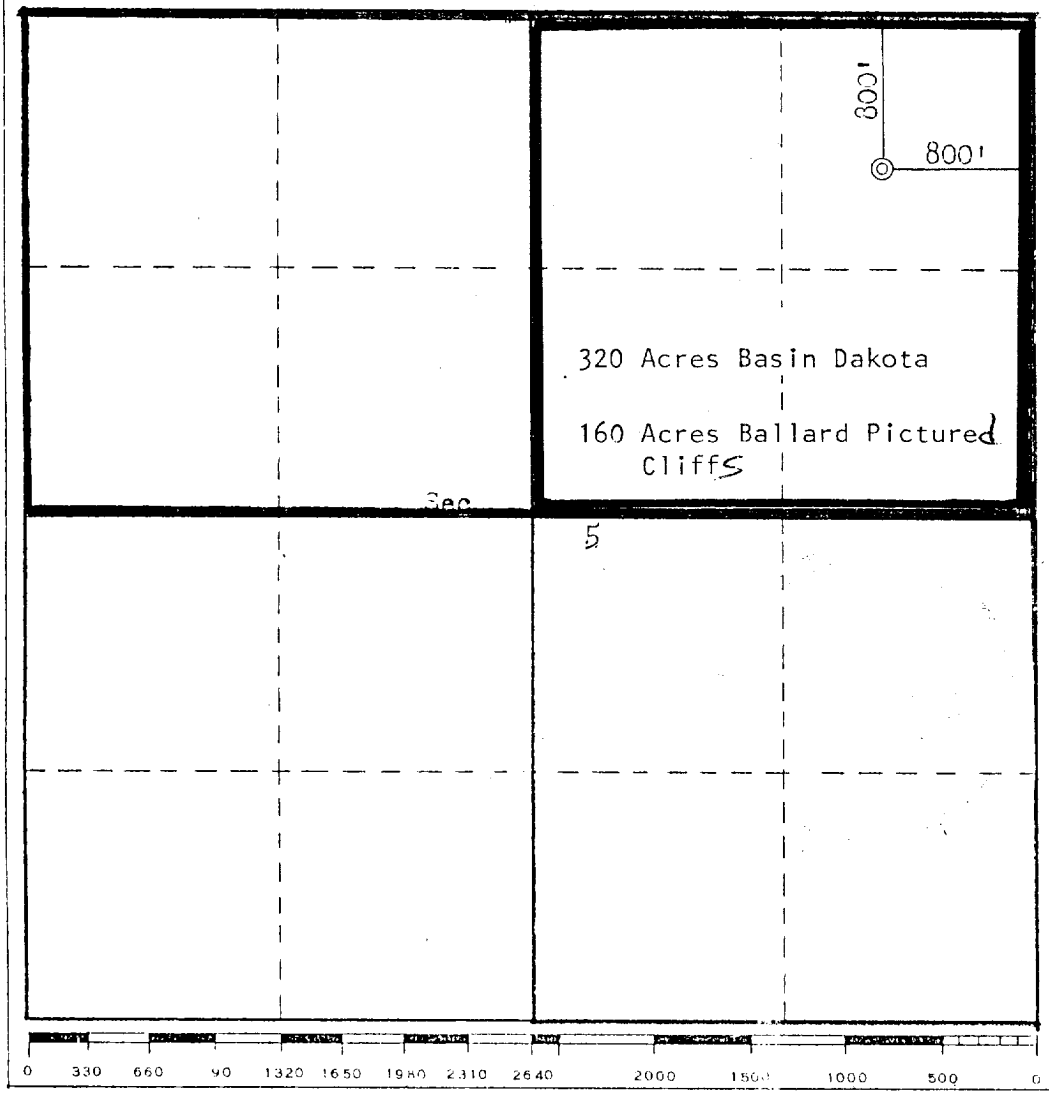
2. If more than one lease is dedicated to the well, outline each and identify the ownership thereof (both as to working interest and royalty).

3. If more than one lease of different ownership is dedicated to the well, have the interests of all owners been consolidated by communitization, unitization, force-pooling. etc?

☐ Yes ☐ No If answer is "yes," type of consolidation N/A

If answer is "no," list the owners and tract descriptions which have actually been consolidated. (Use reverse side of this form if necessary.) N/A

No allowable will be assigned to the well until all interests have been consolidated (by communitization, unitization, forced-pooling, or otherwise) or until a non-standard unit, eliminating such interests, has been approved by the Commission.



CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief.

H O Porter

Name: H. O. Porter

Position: Supv.Drlg.Admin.Svcs.

Company: Amerada Hess Corporation

Date: April 15, 1978

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Date Surveyed: April 4, 1978

Registered Professional Engineer and/or Land Surveyor

Fred B. Kerr Jr.

Certificate No. 3950

FRED B. KERR, JR. NEW MEXICO

AMERADA HESS CORPORATION

P. O. BOX 2040
TULSA, OKLAHOMA 74102
918-584-5554

J. APACHE "M" #1
800' FNL, 800' FEL, Sec. 5
T22N, R3W, Sandoval County, New Mexico

TEN POINT OPERATION PLAN

1. Eocene

2. See drilling well prognosis attached.

3. See drilling well prognosis attached.

4. See drilling well prognosis attached.

5. See BOP layout attached.

6. Fresh water, starch mud with 9.2 - 9.8 ppg

7. (a) Kelly cocks
   (b) Float at bit
   (c) Monitoring equipment on mud equipment
   (d) Sub on floor will have fill opening valve to be stabbed into DP when kelly is not in string.

8. See drilling well prognosis attached.

9. No abnormal pressure or temperature are expected to be encountered or potential hazards such as hydrogen sulphide gas.

10. June 7, 1978.

TULSA

AMERADA HESS CORPORATION
DRILLING WELL PROGNOSIS

DRILLING SERVICES

DATE FEBRUARY 23, 1978

1...LEASE & WELL: Jicarilla Apache "M" #1
Unique FEDERAL LEASE
Base Lease NM-2408

2...LOCATION: 800' FNL & 800 FEL, Sec. 5-T22N-R3W
Sandoval County, New Mexico

3...WORKING INTERESTS: AHC 100% (all objective zones)

4...ELEVATIONS: Ground: 7230' (topographical map)
KB: 7244' (estimated)

5...OBJECTIVE ZONES: Pictured Cliffs @ 2720'
Graneros-Dakota @ 6915'

6...ESTIMATED FORMATIONS MARKERS & TOTAL DEPTH:

Ojo Alamo	2350'
Kirtland-Fruitland	2480'
Pictured Cliffs	2720'
Chacra	3515'
Base Chacra	3680'
Cliff House	4210'
Point Lookout	4809'
Mancos	4990'
Gallup	5740'
Sanastee	6520'
Lower Mancos	6640'
Greenhorn	6825'
Graneros Sand	6915'
Upper Dakota	7075'
Burro Canyon	7180'
Morrison	7280'
TD (for permitting)	7350'
TD (actual projected)	7310'

RGS
NP
HCP
DRH
APAV
RFH
JRW
DC
JM

7...FORMATION EVALUATION PROGRAM:

1)...Sample Program: Catch, wash and bag samples by accepted industry standards. Geologist has reponsibility of changing catching techniques as conditions dictate.

The following are sample intervals and depths:

10' samples from 2400' to total depth, except 5' samples over:

Pictured Cliffs	2650' to 2800'
Chacra	3450' to 3700'
Gallup	5700' to 6100'
Graneros-Dakota	6850' to TD

Preliminary plans are to use Geological staff at Seminole for sample examination and consultation.

2)...Drilling Time & Mud Logger Recorder:

An automatic drilling time recorder will be used and in addition, the geologist can request written drilling time over zones of interest. AHC representative will have the responsibility for the collection of samples and drilling time records.

3)...Coring Program: None Anticipated

4)...DST Program: None Anticipated

5)...Electrical Logging Program:

Induction Electrical, Compensated Density, Compensated Neutron, with Caliper, Gamma Ray and Spontaneous Potential (IEL/CDL/CNL/GR/SP/CL)

2" = 100'	TD to surface casing
5" = 100'	TD to 2400'

Pull GR to surface
(above combination log is now available in Farmington and requires only one trip in well)

"Correlation Logs" - Reynold's Mining Company
#1 Jicarilla in 29-23-3 and their #1 D in 4-22-3.

8...CIRCULATION AND HOLE CONDITIONING:

Make every effort to condition the hole both before and after casing has been run. When flushing, use lost circulation material only and allow all returns to go over the shale shaker.

Circulate and condition as follows:

1) After reaching TD, circulate at least 2 bottoms up or until hole is clean.
2) Short trip 20 stands.
3) Circulate at least 1 bottoms up prior to logging (more if fill was found on bottom).
4) After casing has been run, begin rotation and circulation, continue at least 2 bottoms up. During this time, the mud engineer should make every effort to assure a clean hole. Also, PV and YP should be reduced to $<$ 12 cp and $<$ 5 lbs./100 ft^2

respectively, this will maximuze mud displacement by flush, spacer and cement.

9...MUD PROGRAM:

1)...Drill surface hole to ± 300' using native mud. Discard this mud after setting surface casing.

2)...Mix and condition the following mud before drilling below surface casing. Use a low solids polymer with crude oil added (non-dispersed emulsion).

a) Water Loss - 5 to 7 cc/30 min., must be kept this low to prevent shale sloughing.
b) Viscosity - 35 to 40 sec./qt.
c) Weight - 8.7 to 8.9 ppg., as low as practical to prevent lost circulation.
d) Crude oil - 15% thru Pictured Cliffs, then 10% to TD.
e) Use all solids removal equipment available to keep PV and solids content as low as possible.

3)...Because of heaving shale, high penetration rates, frequent hole flushing and pit jetting, the mud engineer should be on location constantly during the first 3000', also through Gallup and Graneros-Dakota sections.

10...HOLE SIZE, CASING AND CEMENTING PROGRAM:

Drill 13 3/4" hole to ± 300'. Set surface string of 9 5/8" casing.

Cement Surface Casing as follows:

1)...Run a regular pattern guide shoe.

2)...Run an orifice fill insert float collar one (1) joint above shoe.

3)...Use five (5) regular centralizers, equally spaced.

4)...Precede cement with 10 bbl. CW-100 (or equiv.) Mud Flush.

5)...Cement using ± 250 sacks of Class "A" with 3% $CaCl_2$ and 1/4#/sx flocele.

Drill 7 7/8" hole from casing seat to TD. Set production string of 5 1/2" casing.

Cement production casing as follows:

1)...Sandblast 5 1/2" casing through the following intervals:

a) TD to 6870'

b) 2800' to 2680'

2)...Use one (1) regular centralizer above and below the stage collar. And every other collar through the following intervals:

a) TD to 6870'

b) 2800' to 2680'

3)...Use one (1) cement basket below the stage collar.

4)...Run a regular pattern guide shoe.

5)...Run a differential fill float collar one (1) joint above shoe.

6)...Run the stage collar at approximately 2820', 100' below the Pictured Cliffs.

7)...Run rotation-type scratchers ("Roto-Wall") through the following intervals:

a) 7270' to 6900'

b) 2780' to 2700'

8)...Precede both stages with the following flush and spacer:

a) 36 bbl. diesel with 5 gal./1000 FreFlo-C (or Howco's HyFlow)

b) 12 bbl. spacer 1000 (or equiv) with the density at 10 ppg.

c) 24 bbl. CW-100 (or Howco's Mud Flush)

9)...First Stage (TD through Gallup)

Pump 300 sacks 65-35 Class "A" poz-mix with 6% gel, 6 1/4#/sx. gilsonite and .75% TIC (or CFR-2). Tail in with 100 sacks class "G" with 10% salt and .75% TIC. Rotate pipe before and during the first stage. Maintain maximum rate to assure turbulen flow.

Total slurry volume should be based on 130% of Caliper Log volume from TD through the Gallup.

Displace first stage with 90 bbl. Fresh water followed by mud. Open stage tool, WOC and circulate slowly for 4 hours.

10)...Second Stage (Pictured Cliffs through Ojo Alamo)

Pump 150 sacks 65-35 Class "A" poz-mix with 6% gel, 6 1/4#/sx Gilsonite and .75% TIC (or CFR-2). Tail in with 50 sacks Class "G" with 10% salt and .75% TIC. Again, maintain maximum rate to assure turbulent flow.

Total slurry volume should be based on 130% of Caliper Log volume from stage collar through the Ojo Alamo.

Displace second stage with fresh water.

11)...All cements should be tested by San Juan Testing Lab prior to their use. This is necessary due to the wide variance in quality of Tijeras Canyon cements.

12)...Recommend renting a trailer for drilling services personnel.

11...UNUSUAL CONDITIONS:

1)...Expect shale sloughing and caving down to ± 3000', especially from 1600' to 2000'.

2)...Possible lost circulation in the Gallup section.

12...GOVERNMENT AGENCY REQUIREMENTS:

1)...Deviation test shall be made at least once every 500' or at the first bit change succeeding 500'. Maximum hole deviation is five (5) degrees over any 500' interval.

2)...Final electrical log prints should be filed with USGS and NMOCC.

3)...Archaeological survey is required prior to building location.

13...LOG DISTRIBUTION:

Field Prints

1 - Drilling Services (Tulsa)
2 - Technical Services (Tulsa)
1 - Drilling Supervisor
2 - Farmington Office
1 - Monument Office
3 - Seminole Office
1 - Geological (Tulsa)

Final Prints

3 - Farmington Office
3 - Monument Office
2 - Seminole Office
1 - Technical Services (Tulsa)
1 - Geological (Tulsa)

Film Original, Sepia and Data Tapes

1 - Each Technical Services (Tulsa)

Addressess

Amerada Hess Corporation
P. O. Box 68
Farmington, N.M. 87401

Amerada Hess Corporation
Drawer "D"
Monument, N.M. 88265

Amerada Hess Corporation
P. O. Box 840
Seminole, Texas 79360

Amerada Hess Corporation
P. O. Box 2040
Tulsa, Oklahoma 74102

14...CONTACTS:

Seminole, Texas - Office (915) 758-5801
Monument, N.M. - Office (505) 393-2145
Engineer - Dave Bertschinger - Home - (505) 392-8977
Geologist - Ron Lakson - Home - (915) 758-2861
Contractor - Harv Henry - Office - (505) 325-4042
Home - (505) 327-9967
Production Supervisor - Tommy Adams - Farmington

Prepared by [illegible]

Date [illegible]

Night Tulsa Telecopier (918) 584-5620
Night Seminole Telecopier (915) 758-3141 (use #6 setting)

Region Approval EM [illegible]
R. L. L.
[illegible]

[illegible] 4-10-78

J. APACHE "M" #1
800' FNL, 800' FEL, Sec. 5
T22N, R3W, Sandoval County, New Mexico

1. Existing Roads - a legible map showing:

   A. 800' FNL, 800' FEL, Section 5, T22N, R3W, Sandoval County, New Mexico.

   B. Approximately 25 miles North Cuba, New Mexico. Topo and road maps attached.

   C. Approximately 1500' right of way to location.

   D. See maps attached.

   E. N/A

   F. Only usual grading.

2. Planned Access Roads - map of suitable scale indicating all necessary access roads to be constructed or reconstructed, showing:

   A. 30'
   B. 2%
   C. None
   D. None
   E. None
   F. Dirt and Rock
   G. None

3. Location of Existing Wells - a two-mile radius map if exploratory, or 1-mile radius map if development well, showing and identifying existing:

   A. None
   B. None
   C. None
   D. None
   E. See plat attached.
   F. None
   G. None
   H. None

4. Location of Existing and/or Proposed Facilities

A. None

(1) Wildcat location
(2) Ditto
(3) Ditto
(4) Ditto
(5) Ditto
(6) Ditto

B. (1) Will use drilling pad for producing facilities.
(2) 275' X 145'
(3) Grade
(4) To be fenced if necessary.

C. Clean, level and reseed.

5. Location and Type of Water Supply

A. None

B. Trucked

C. None

6. Source of Construction Materials

A. None

B. None

C. None

D. 1500' right of way to location (grade only)

7. Methods for Handling Waste Disposal

A. (1) Drilling cuttings will be disposed of in pits.
(2) Drilling fluids will be allowed to evaporate in pits.
(3) Fluids produced during drilling will be put in pits.
(4) Current laws and regulations will be complied with.
(5) Garbage and other waste material will be fenced and destroyed in compliance with regulations.
(6) Location after drilling will be leveled, filled & reseeded.

8. Ancillary Facilities

A. None

9. Well Site Layout - a plat (not less than 1" = 50') showing:

A. See layout attached.
B. Ditto
C. Ditto
D. Pits are to be lined.

10. Plans for Restoration of Surface

A. After completion of drilling, all areas will be cleaned, leveled and reseeded depending on weather conditions as soon as possible.

11. Other Information

A. See archeologist report to USGS.

12. Lessee's or Operator's Representative

L. L. Jones, Jr.

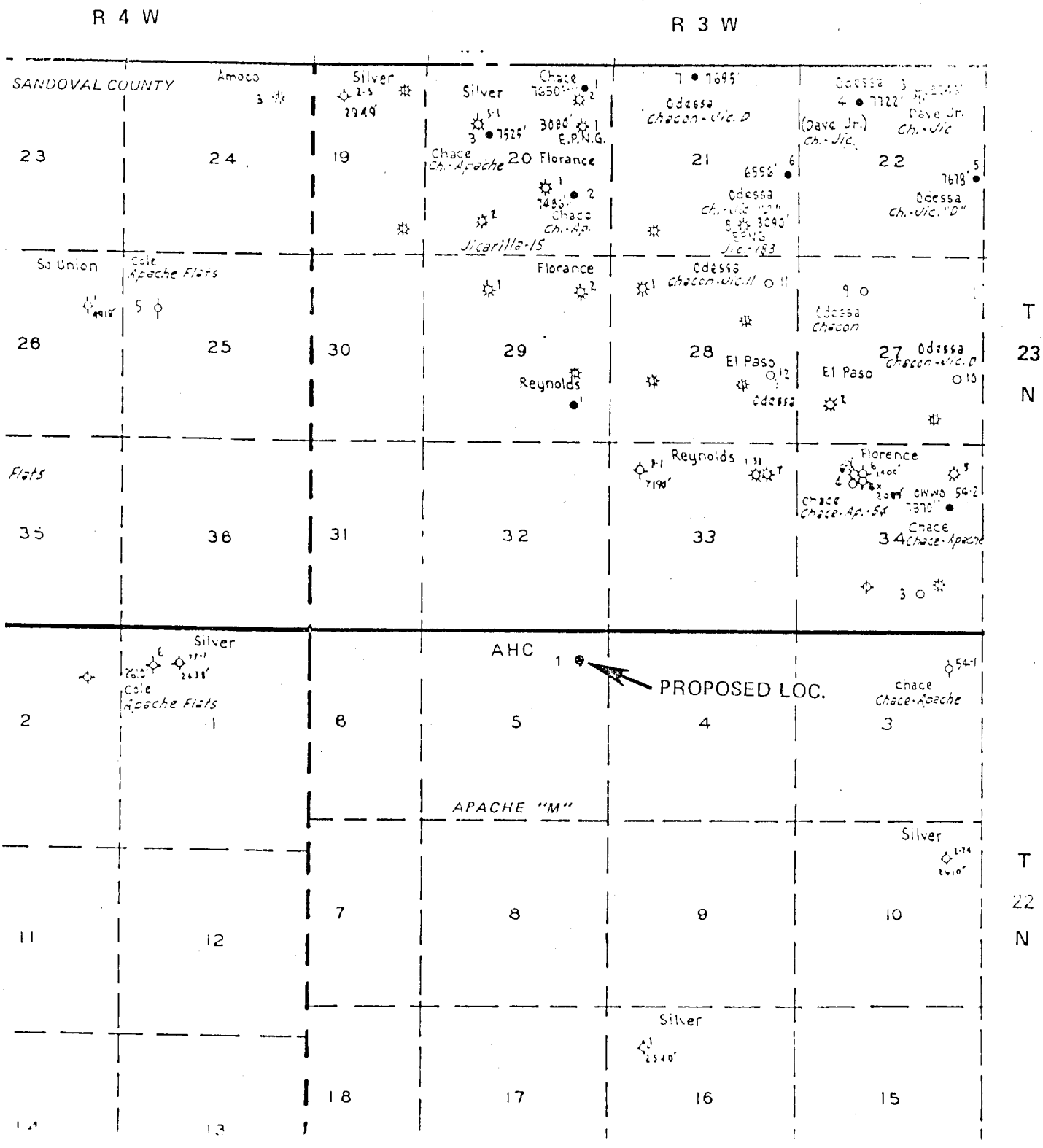
13. Certification

I hereby certify that the proposed drill site and access route has been inspected. That I am familiar with the conditions that presently exist, that the statements made in this plan are the best of my knowledge true and correct, and, that the work associated with the operations proposed herein will be performed by Amerada Hess Corporation and its contractors and sub-contractors in conformity with this plan and the terms and conditions under which it is approved.

H. O. Porter

H. O. Porter
Supervisor Drilling Administrative Services

HOP:dc

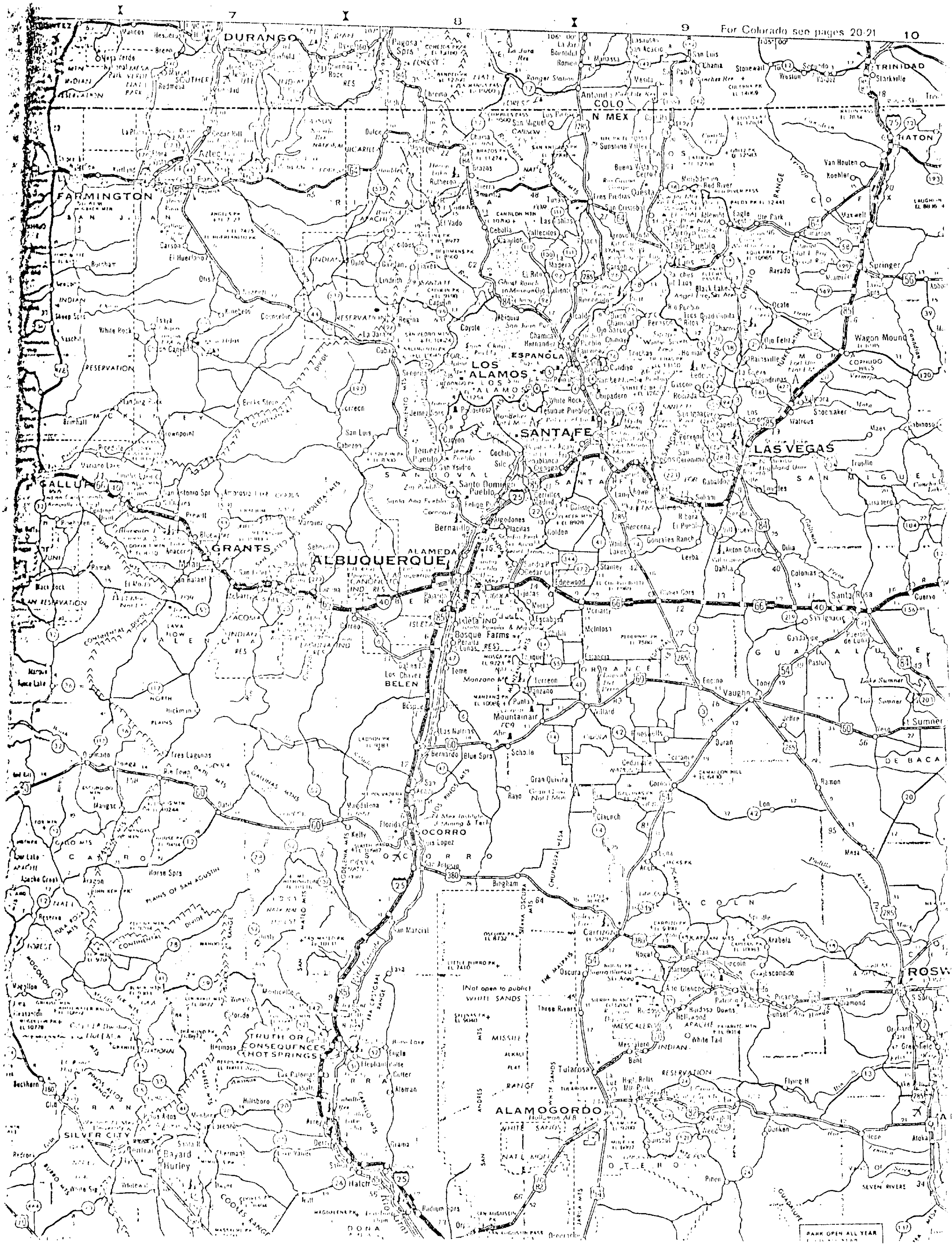


OTERO FIELD

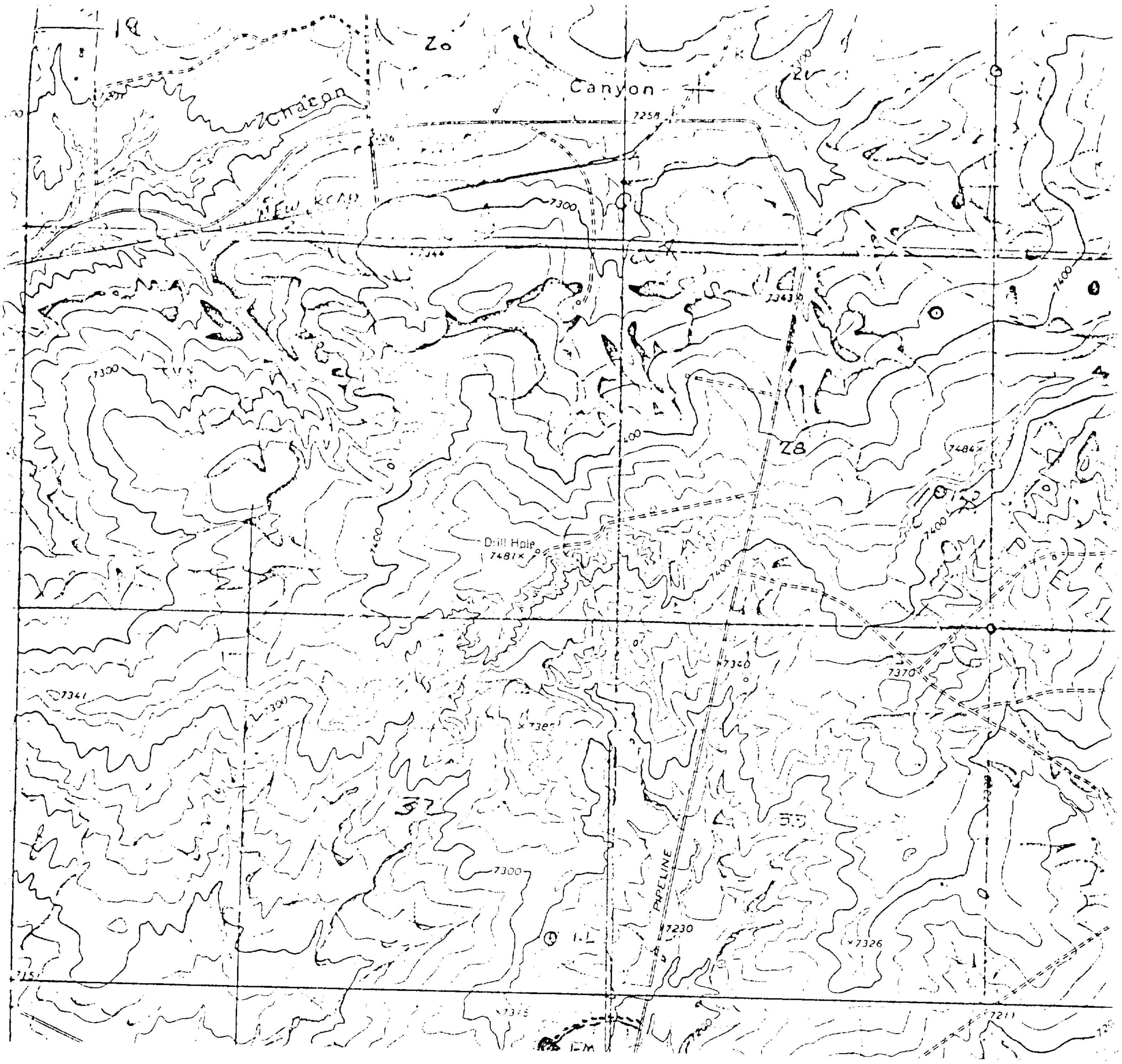
Sandoval County, New Mexico

JICARILLA APACHE "M"

SCALE: 1" = 4000 FT.



7
8
9
10
For Colorado see pages 20-21
DURANGO
Pagosa Spgs
TRINIDAD
COLO
N MEX
RATON
Aztec
FARMINGTON
Dulce
Chama
Tres Piedras
Questa
Red River
Eagle Nest
Cimarron
Springer
Taos
Ranchos de Taos
El Rito
Abiquiu
Cuba
Coyote
ESPANOLA
LOS ALAMOS
SANTA FE
LAS VEGAS
Wagon Mound
Watrous
GALLUP
GRANTS
Bernalillo
ALAMEDA
ALBUQUERQUE
Santa Rosa
Cuervo
Isleta
Bosque Farms
Los Lunas
BELEN
Estancia
Moriarty
Mountainair
Vaughn
Encino
Duran
Ft Sumner
Magdalena
SOCORRO
San Antonio
Bingham
Carrizozo
Oscura
Capitan
Lincoln
Ruidoso
Hollywood
Tularosa
ALAMOGORDO
ROSWELL
TRUTH OR CONSEQUENCES HOT SPRINGS
Hatch
Hillsboro
SILVER CITY
Bayard
Hurley
Reserve
Quemado
Datil
Pie Town
Aragon
Mesa
Ramon
Corona
Gran Quivira
Three Rivers
Mescalero
Cloudcroft
Atoka
SEVEN RIVERS
WHITE SANDS
PARK OPEN ALL YEAR

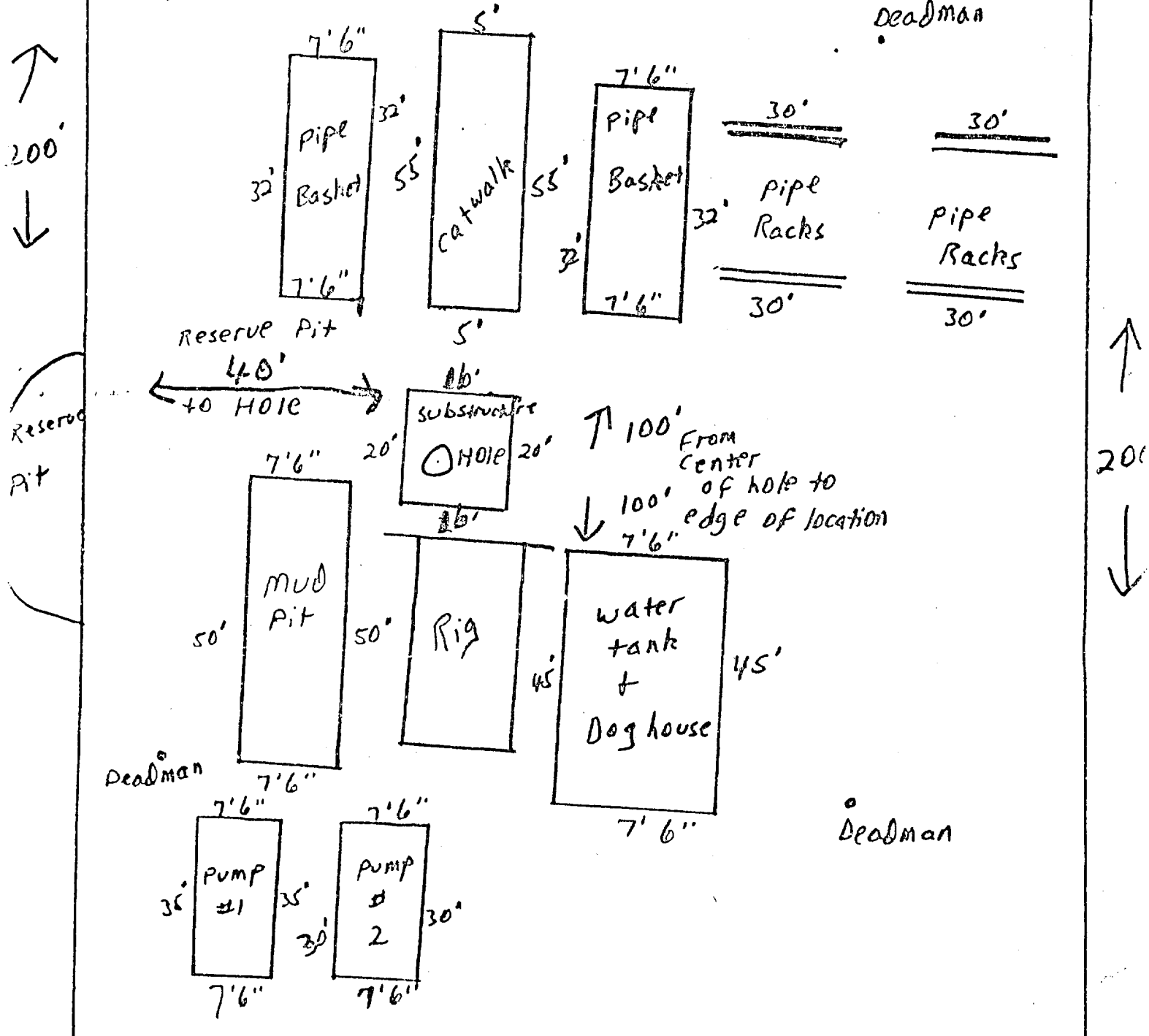


Canyon
Chacon
NEW ROAD
Drill Hole
7481
7300
7258
7344
7343
7484
7341
7385
7340
7370
7230
7326
7375
7211
PIPELINE

PHONE 334-6191
P. O. BOX "B"
TULSA
AZTEC WELL SERVICING CO
AZTEC, NEW MEXICO 87401
WAYNE SANDEL
PRESIDENT

150'

Deadmen setting 75' from well each way & 75' across 1/2 each way.



RIG #124 Layout

150'

AMERADA HESS CORPORATION

STANDARD PROCEDURES

FOR

BLOW OUT PREVENTION

AND CONTROL

EQUIPMENT

The following blow out prevention, monitoring, and control equipment is to be installed on all AHC operated drilling wells:*

1. Minimum of 2 ram type B.O.P.'s with pipe rams in lower preventor and blind rams in the upper preventor with a flow cross flanged between. A third B.O.P. should be required when operating with a tapered drill string. The B.O.P.'s should have at least the same pressure rating as the well head on which they are installed. The preventors are to be operated hydraulically by an adequate opening and closing system. Manual hand wheels with extensions are to be attached to the B.O.P.'s.
2. 1-bag type B.O.P., hydraulically operated as above, with an element in good condition, and to be of at least the same pressure rating as the ram type B.O.P.--up to 10,000 PSI.
3. B.O.P. manifold with hydraulic and manual inside valves and with two choke lines and one open line with proper block valves. All piping and valves to be of at least the same pressure rating as the B.O.P. stack.
4. Pit level monitoring device with at least one read out device at the driller's station.
5. Flow rate monitoring device with pump stroke counters connected to both pumps and with automatic trip fill up device with total read out device at the driller's station.

In addition to the equipment listed above, the following equipment is to be installed on any AHC operated drilling well that expects to drill an abnormally pressured zone, or is considered a wildcat well:

6. Hydraulically operated adjustable choke of at least the same pressure rating as the manifold to which it is connected.

7. Adequate mud gas atmospheric separator and mechanical degasser.

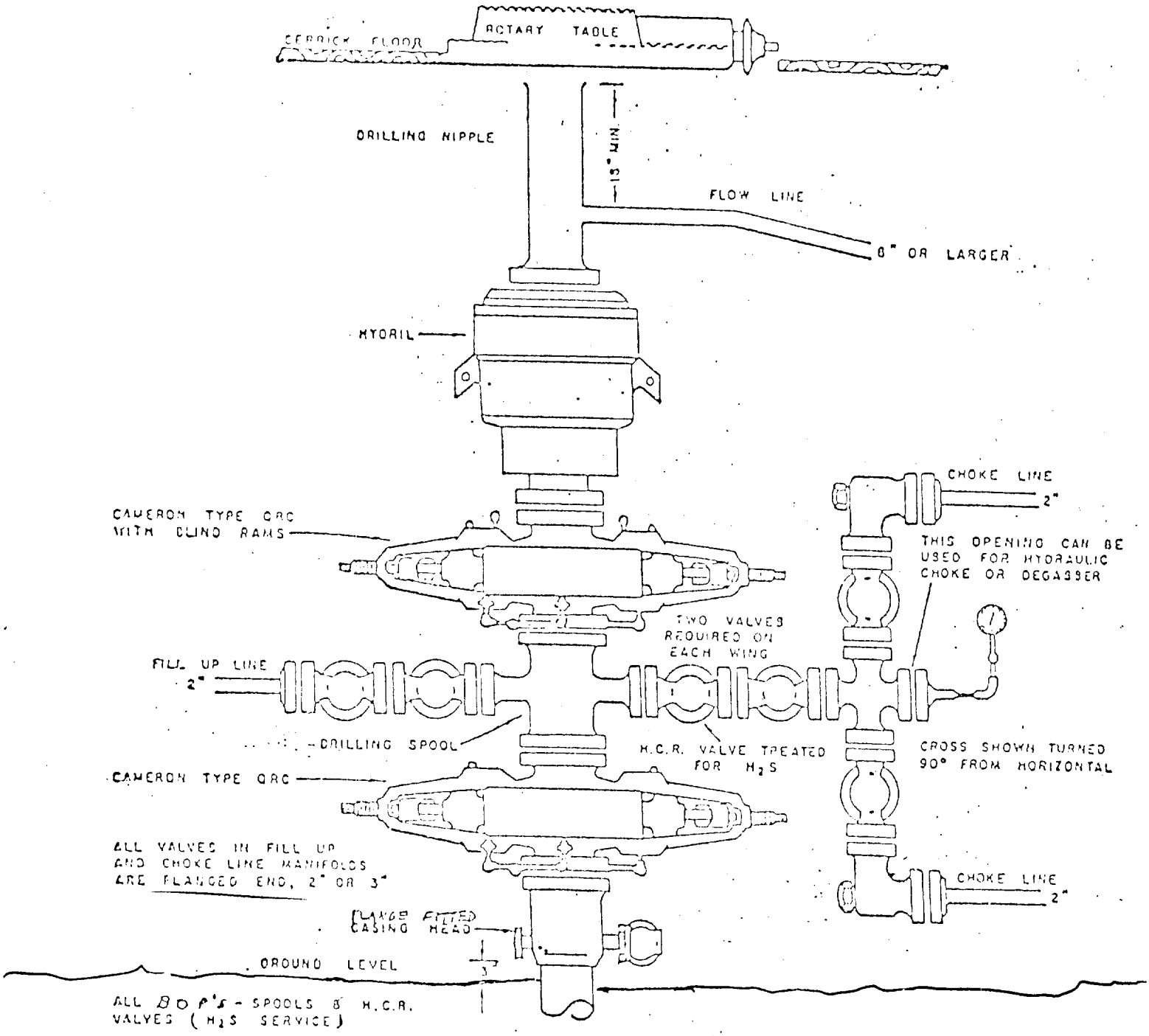
8. Automatic mud weighing device with chart read out recording at least the return mud weight.

9. Chart read out of the flow rate, and pit volume totalizer devices listed above.

10. At least a portable mud gas detector and shale density kit, or when conditions or expectations warrant--a complete mud logging unit is to be installed.

11. Adequate mixing facilities and storage for bulk barite materials.

*Items 1 through 5 maybe subject to some variations, as unusual conditions arise.



AMERADA HESS CORPORATION'S

LAYOUT PLAN FOR REQUIRED
BLOWOUT PREVENTER
ASSEMBLY

PRECAUTIONS

1. Properly rated and perfectly operating blow out preventors and control equipment are installed on the well.
2. At least the following devices are installed and monitored: Pit volume totalizer, flow rate recorder, and trip fill up counter. In addition, pump strokes, pump pressure, mud weight, and bit weight are analyzed for unusual values. On some of the more complex wells, an adjustable choke, degasser, mud weighing device, mud logging unit and bulk barite facilities will also be installed and monitored.
3. Drilling breaks are checked for flow at 3 feet and 10 feet into the break. If the break is of considerable magnitude, it is circulated out, especially if drilling in the proximity of a transition zone.
4. Gas cut mud is considered as a warning, and its cause and extent examined to satisfaction.
5. The hole is filled each 5 stands while pulling out of the hole and pump strokes and pit level decrease are measured and compared against calculated displacement values.
6. Formation pore pressures and fracture pressures are calculated from electric logs and used to aid in proper casing seat selection and mud weight ranges.

PREPARATIONS

1. Maximum safe pressure values are calculated and made known for surface equipment and all casing strings, along with fracture pressure at deepest casing shoe or weakest exposed formation.
2. Conduct regularly scheduled (every 5 - 7 days or as conditions warrant) pressure tests of blow out preventers and control equipment to maximum working pressure with clear water. Check flange bolts for tightness.
3. Work blow out preventors, hydraulic valves, and adjustable choke every trip and pump through choke manifold every other trip.
4. Have choke lines tied into a stack (atmospheric) separator.
5. Establish who has the responsibility for detecting a kick and shutting the well in. This should include checking fill up on trips and watching the hole while other operations are being conducted.
6. Establish who will do what during the killing operation and explain to all why each job is important to the success of killing the well.
7. Conduct surprise drills on kick detection and shut in procedures.
8. For maximum safety it is important that pipe rams be placed in the bottom ram type preventor so the well can be shut in if something cut out in the upper section of the B.O.P. stack or if it is necessary to change rams.
9. Use clean hydraulic oil in the accumulator unit and check level weekly.
10. Each person who is to operate the hydraulic adjustable choke should be completely familiar with the mechanics and operation of the choke.
11. In order to provide necessary data for the killing operation, pump pressures are recorded each tour for pump speeds of 20 and 30 strokes per minute. This data is also repeated if the mud weight is increased during a tour.

DETECTION

The importance of rapid kick detection and fast shut in cannot be over-stressed. Kicks can be detected by the following indications, or combinations thereof:

1. Increase in surface pit volume as detected by pit volume totalizer or a man on the pits.
2. Increase in return mud flow rate as detected by the flow rate monitor.
3. Decrease in drill pipe pressure, caused by oil, gas, or salt water entering the annulus and unbalancing the hole.
4. Gas or salt water cut mud returns caused by a kelly cut, shale gas, drilled pore volume, trip bottoms up, or drilling a high pressure-low volume formation.
5. Rate of penetration increase, especially if drilling in the proximity of an abnormally pressured zone.
6. Hole swabbing on trips as detected by the hole taking an insufficient amount of mud for the calculated pipe displacement, or the occurance of a high concentration of gas upon circulating bottoms up after a trip.